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TECHNICAL MEMORANDUM 86/210

April 1986

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SWSPA - A COMPUTER PROGRAM PACKAGE
FOR
SEAKEEPING PERFORMANCE ASSESSMENT
OF SWATH SHIPS

W.C.E. Nethercote

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**SWSPA - A COMPUTER PROGRAM PACKAGE
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SEAKEEPING PERFORMANCE ASSESSMENT
OF SWATH SHIPS**

W.C.E. Nethercote

April 1986

Approved by B.F. Peters A/Director/Technology Division

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ABSTRACT

A computer program package for assessing the seakeeping performance of SWATH ships is described. This package is based on an existing ship motion computer program, SWATM2. The seakeeping performance analysis process is automated and combined with a recently-published North Atlantic wave data base. The resulting package performs the following functions:

- (1) Computes ship motions for the entire range of sea conditions for a user-specified ocean area in the North Atlantic.
- (2) Applies seakeeping criteria to compute seakeeping performance parameters, such as maximum sustainable speed and maximum effective speed, for each heading and sea condition.
- (3) Averages the seakeeping performance parameters over all headings to obtain mean values for each sea condition.
- (4) Obtains averages over all sea conditions by weighting each sea condition in accordance with the North Atlantic wave data base. ↗

RESUME

On décrit un ensemble de programmes d'ordinateur pour l'évaluation de la tenue à la mer des navires SWATH. Cet ensemble est basé sur un programme existant d'étude des mouvements des navires, le SWATH2. Le processus d'analyse de la tenue à la mer est automatisé et combiné à une base de données sur les vagues dans l'Atlantique-Nord publiée récemment. L'ensemble résultant de programmes exécute les fonctions suivantes:

- (1) Il calcule les mouvements de navires pour toute la gamme des états de la mer dans une région de l'Atlantique-Nord spécifiée par l'utilisateur.
- (2) Il applique des critères de tenue à la mer pour calculer des paramètres de la tenue à la mer comme la vitesse soutenable maximum et la vitesse vraie maximum pour chaque cap et chaque état de la mer.
- (3) Il calcule une moyenne des paramètres de tenue à la mer pour l'ensemble des caps afin d'obtenir des valeurs moyennes pour chaque état de la mer.
- (4) Il calcule des moyennes pour l'ensemble des états de la mer en pondérant chacun des états conformément à la base de données sur les vagues dans l'Atlantique-Nord.

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TABLE OF CONTENTS

ABSTRACT	ii
NOTATION	v
1. INTRODUCTION	1
2. DEFINITION OF KEY SEAKEEPING PERFORMANCE PARAMETERS	3
3. SWATH PACKAGE FOR SEAKEEPING PERFORMANCE ASSESSMENT	5
3.1 General Computational Procedure	
3.2 Use and Limitations of Linear Superposition	
3.3 SWPA	
3.4 CONVER	
3.5 SWSPA	
3.6 Use of the SWSPA Package	
4. CONCLUDING REMARKS	11
TABLES	13
APPENDIX A: USER'S MANUAL FOR THE SWSPA PACKAGE	19
APPENDIX B: SAMPLE INPUTS AND OUTPUTS FOR THE SWSPA PACKAGE	23
REFERENCES	59

NOTATION

Mathematical Terms

E	effectiveness factor
E_l	lateral acceleration effectiveness factor
E_o	overall effectiveness factor
E_r	roll effectiveness factor
E_v	vertical acceleration effectiveness factor
F_h	heading operational fraction
F_o	ocean area operational fraction
H	significant waveheight
HREF	reference significant waveheight
m_H	rms motion at waveheight H
m_{HREF}	rms motion at waveheight HREF
R	rms roll
R_c	roll non-linearity correction factor
T_o	wave modal period
V_E	ocean area average of maximum effective speed
V_e	maximum effective speed for a given heading and sea state
V_S	ocean area average of maximum sustainable speed
V_s	maximum sustainable speed for a given heading and sea state
VK	speed
X	rms motion

Program Variable Names

ALMX(I)	limiting lateral rms acceleration at station I
ALMAX	rms lateral acceleration for zero effectiveness
ALMIN	rms lateral acceleration for 100% effectiveness
AVMX(I)	limiting vertical rms acceleration at station I
AVMAX	rms vertical acceleration for zero effectiveness
AVMIN	rms vertical acceleration for 100% effectiveness
BXCL	box clearance
COSBET	cosine of heading angle

DEPCAT dummy variable
 DRST draft
 EXPMAX machine dependent floating underflow/overflow criterion
 FREEB freeboard
 H(I) ith significant waveheight in ocean area
 HREF significant waveheight for responses given in SCSTMOT.DAT
 ICHECK execution control integer
 IEQ exciting force and equation of motion output control integer
 IFIN ship motion control fin indicator
 IMEAN effectiveness array output control integer
 IPRINT PERF array file control integer
 IREG regular wave response output control integer
 ISAVE naked hull added mass and damping method control integer
 ITERM batch/interactive control integer
 JJ sea state index
 LX added mass and damping file control integer
 MM sea direction index
 NBTA number of headings
 NFN number of Froude numbers
 NSEA number of wave periods
 NSTR number of stations
 NUM number of waveheights in ocean area
 NUN units designator (British/Metric)
 PB(JS,K) probability of sea state occurrence at waveperiod, JS, and
 waveheight, K
 PDW probability limit for relative motions, typically deck wetness
 or box impact
 PITCH limiting value of rms pitch
 RBMHT height above still waterline
 RBMST station number
 RMAX rms roll angle for zero effectiveness

RMIN rms roll angle for 100% effectiveness
ROCORR roll non-linearity correction factor
ROLL limiting value of rms roll
SD dummy variable
SINBET sine of heading angle
SP ship speed, knots
SPREAD spectral spreading angle
TSW wave period
VVMX(I) limiting vertical velocity at station I
WANG heading angle
ZPOS height above centre of gravity

1. INTRODUCTION

Computer programs for predicting ship motions in waves have come into common use during the past decade. First to see widespread use were programs to predict vertical plane motions (pitch and heave) in head seas and hence such motion-related phenomena as slamming and deck wetness. More recently, programs which compute lateral motions (sway, roll and yaw), as well as vertical motions, at any heading to the sea, have become available; an example is DREA's SWATM2¹ program, which performs such calculations for SWATH (Small Waterplane Area Twin Hull) ships.

SWATM2 is structured to perform comprehensive ship absolute and relative motion computations for up to ten sea states on a single computer run. Using these outputs, one can make a comprehensive assessment of ship seakeeping performance for the specified sea states. Unfortunately, manual analysis of SWATM2's output can be very time-consuming, particularly when many seakeeping parameters must be considered together with many combinations of sea state, heading and speed. Automation of this analysis is highly desirable.

The selection of appropriate sea states for seakeeping performance analysis is itself of much importance. This choice should be based on sea state statistics for the ocean areas of primary operational importance to the ship under consideration. Until recently, statistical data of this nature have been rather limited. The principal source has been Reference 2, which is based on visual observations made aboard ships of opportunity, with the attendant inevitable biases toward fine weather operation and particular trade routes. Also, visual observations of wave period are unreliable.

Because of the limitations of such sources of wave data as Reference 2, the U.S. Navy in 1975 initiated a project to develop a new wave and wind data base for the Northern Hemisphere using its Spectral Ocean Wave Model. This model takes wind field data as input, from which wave systems are predicted and followed as they propagate throughout the ocean basins. The model has roughly 2000 grid points throughout the Northern Hemisphere, and at each of these the propagated wave energies are summed to provide the local prediction. In the US Navy project, archived wind fields, based on measurements, are used to hindcast wave spectra at six-hour intervals for a period of 20 years (1959-1979). A description of the project is given in Reference 3.

In 1979, as part of the program of work of a NATO sub-group (NATO Naval Armaments Group, Information Exchange Group 6 on Ship Design, Sub-Group 5 on Seakeeping), the US Navy undertook to develop a source document for specifying wave and wind conditions for NATO operational areas, based largely on the twenty year hindcast project. This recently-published source document⁴ provides a comprehensive and

accurate set of wave data for the North Atlantic; furthermore, the data are presented in a format very well suited to seakeeping performance assessment. Reference 4 is the basis for a recently-promulgated NATO Standardization Agreement⁵ on wave and wind environment.

In Reference 4, the North Atlantic is divided into the ocean areas shown in Figure 1. For areas 00, 0, 1, 2, 4, 6, 7, 10, 11, 16 and 17 the following data are tabulated:

- (1) significant wave height vs. modal wave period,
- (2) significant wave height vs. wind speed,
- (3) significant wave height vs. primary wave direction,
- (4) wind speed vs. wind direction,
- (5) persistence of significant wave height, and
- (6) persistence of wind speed.

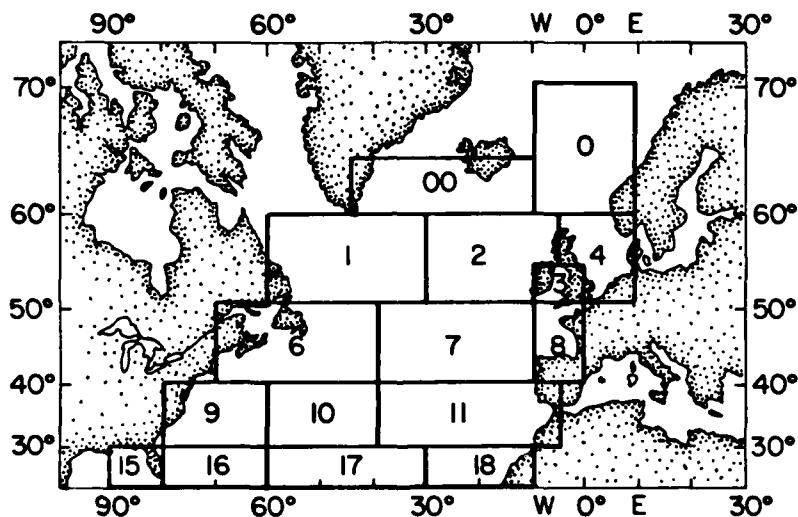


Figure 1: Definition of Representative Areas in the North Atlantic Basin

The tables of significant wave height vs. modal wave period are especially useful. The format is shown in Table 1, which gives annual percentage occurrence of wave height as a function of wave period, averaged over the entire North Atlantic (i.e. all the ocean areas shown in Figure 1). From this table, one can select the appropriate sea conditions (combinations of wave height and period) for performing sea-keeping performance assessments for ships operating in the North Atlantic. Also, percentages given in Table 1 can be used to weight the results computed for particular sea conditions, in order to obtain over-all estimates of performance.

The usefulness of automating the seakeeping analysis process has already been mentioned. Combining this automated analysis with the North Atlantic wave data of Reference 4, as exemplified by Table 1, obviously would result in a very useful tool. The concept thus emerges of a computer program which would perform the following operations:

- (1) compute ship motions for each of the wave height-period combinations in Table 1 for which percentage occurrence > 0, covering a full range of speed and heading for each;
- (2) apply seakeeping criteria to compute seakeeping performance parameters (such as maximum sustainable speed) for each heading and sea condition; and
- (3) obtain averages of seakeeping performance parameters over all sea conditions by weighting each sea condition in accordance with Table 1.

This technical memorandum describes such a computer program for SWATH ships.

2. DEFINITION OF KEY SEAKEEPING PERFORMANCE PARAMETERS

In assessing a ship's seakeeping performance, the goal is to establish how ship motions and related phenomena affect operational capability. Hence one must compute such parameters as: maximum sustainable speed, maximum effective speed, crew effectiveness factors (as a function of ship motions), and fraction of sea conditions for which specified ship operations can be performed without exceeding ship motion limits. The seakeeping performance parameters used herein are defined below.

Sustainable speed, V_s , is the maximum speed which a ship can maintain on a given heading in a given seaway without exceeding specified limits on slamming, deck wetness and motions (roll, pitch, vertical velocity and acceleration, and lateral velocity and acceleration).

Effectiveness factor, E , accounts for the degradation in crew performance as a result of ship motion. Let X be the root mean square (rms) value of a ship motion known to affect crew performance significantly. Then, for given speed, heading and sea condition, the associated effectiveness factor E is computed using the following equation:

$$E = \begin{cases} 100 & X \leq X_{MIN} \\ 100[1 - (X - X_{MIN}) / (X_{MAX} - X_{MIN})] & X_{MIN} < X < X_{MAX} \\ 0 & X \geq X_{MAX} \end{cases} \quad (1)$$

That is, effectiveness is assumed to be 100% for rms values below X_{MIN} , 0% for values above X_{MAX} , and to vary linearly in between, as illustrated in Figure 2. Four types of effectiveness factors are defined: vertical acceleration, E_v ; lateral acceleration, E_l ; roll angle, E_r ; and the overall effectiveness factor, E_o , which is the minimum of E_v , E_l , and E_r .

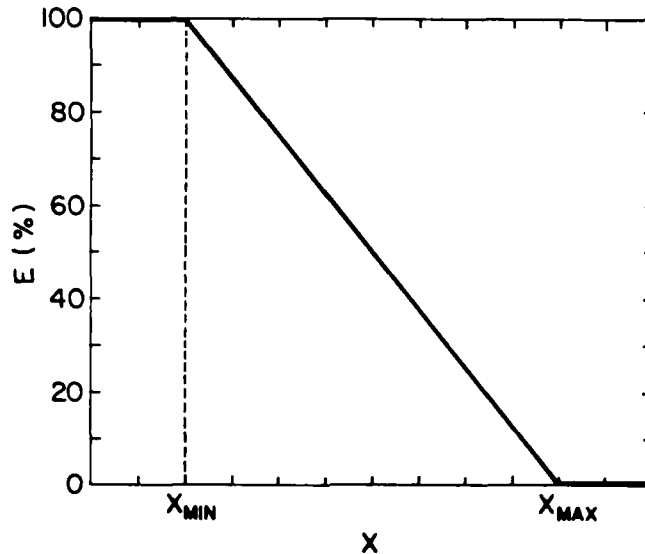


Figure 2: Effectiveness Factor

For a given heading and sea condition, effective speed, V_e , is the maximum speed which a ship can maintain with acceptable effectiveness, i.e. $E_o \geq \text{EFFMIN}$, where EFFMIN is a user-specified minimum acceptable level of effectiveness (say 70%).

For a given speed and sea condition, heading operational fraction, F_h is the fraction of all possible headings for which limits on slamming, deck wetness and motions are not exceeded and $E_o \geq \text{EFFMIN}$.

For a given speed and ocean area, ocean area operational fraction, F_o is the fraction of headings and sea conditions for which limits on slamming, deck wetness and motions are not exceeded and $E_o \geq \text{EFFMIN}$. Thus the ocean area operational fraction is the heading operational fraction averaged over all possible sea conditions for the specified ocean area.

3. SWATH PACKAGE FOR SEAKEEPING PERFORMANCE ASSESSMENT

3.1 General Computational Procedure

To accomplish the SWATH seakeeping performance assessment, a package has been developed consisting of four programs:

- (1) SWATM2 is used to check ship input data and to compute factors to compensate for roll non-linearities;
- (2) SWPA calculates motions in long-crested seas and generates a data file of rms motions for a user-specified speed range (typically 5-30 knots at 5 knot intervals), a number of headings (typically 13, 0° to 180° at 15° intervals), and a number of wave modal periods (typically 13). A typical case of 6 speeds and 13 headings and modal periods gives 1014 speed/heading/period combinations;
- (3) CONVER uses the data file generated by SWPA to calculate rms motions in short-crested seas for the same speed/heading/period combinations as generated by SWPA; and
- (4) SWSPA - SWATH Seakeeping Performance Assessment - uses the rms motion data file generated by CONVER to compute ship motions at each speed and heading for each wave height-period combination for which probability of occurrence is greater than two in the specified ocean area.

Taking the case given in Table 1 as an example, with 6 speeds and 13 headings there will be $6 \times 13 \times 78 = 6084$ combinations of speed, heading and sea condition. SWSPA then applies seakeeping criteria to compute the seakeeping performance parameters defined in Section 2. These are then averaged over all headings to obtain mean values for each sea condition. Finally, averages over ocean area are computed by weighting each sea condition in accordance with its percentage of occurrence. The format of the resulting output is illustrated in Table 2.

3.2 Use and Limitations of Linear Superposition

Linear superposition is a basic assumption of all linear seakeeping theories: quite simply, motions are assumed to be proportional to waveheight. Fortunately, at moderate waveheights the linearity assumption is generally acceptable for all motions except roll, where an artifice is generally employed to account for non-linear viscous roll damping.

Typically, linear strip theory computer programs replace non-linear damping by an equivalent linear damping term which dissipates the same amount of energy in one roll cycle. Knowledge of roll angle is required for the linearization so an iterative solution to the damping and predicted roll angle may be necessary.

In the SWSPA package, SWPA and CONVER assume linearity and calculate irregular seas responses for one significant waveheight to save file space. When the final program, SWSPA, is used a correction is necessary for roll non-linearity.

Roll damping has linear and quadratic components so that a quadratic relationship between rms roll, R , and waveheight, H , can be assumed as shown in Figure 3.

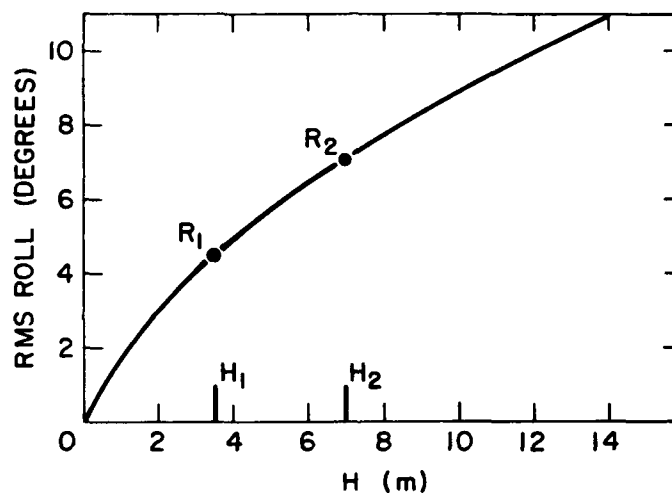


Figure 3: Quadratic form of R vs H for a typical case.

A roll non-linearity correction factor, R_c , can be defined as

$$R_c = R_2/R_1 \quad (2)$$

where R_1 is rms roll angle in irregular beam seas of significant height HREF;

and R_2 is rms roll angle in irregular beam seas of significant height 2 X HREF

The quadratic relationship of R and H

$$aR^2 + bR + H = 0 \quad (3)$$

can be rewritten as

$$R = [-b + (b^2 + 4 aH)^{1/2}]/(2a) \quad (4)$$

where it can be shown that

$$a = [HREF/(R_C^2 R_1)](2 - R_C)/(R_C - 1) \quad (5)$$

and
$$b = (HREF - a^2 R_1)/R_1 \quad (6)$$

So, R_C is derived from the initial SWATH2 run and is used in equations (3) to (5) to determine roll angles in SWSPA.

3.3 SWPA

SWPA is a modified version of SWATH2. The principal change is to output, where a computer disk file of rms motions is stored for later use by CONVER.

The input to SWPA differs from that of SWATH2 in only one respect: it is possible to specify that the program output the basic hull added mass and damping coefficients to a file which can be used by later program executions in lieu of calculation of these coefficients.

A simplified flow chart for SWPA is given in Figure 4; it is essentially the same as for SWATH2.

SWPA calculates the following rms motions in unidirectional seas:

- (1) roll,
- (2) pitch,
- (3) vertical relative motion at up to 15 stations,
- (4) vertical relative velocity at up to 15 stations,
- (5) vertical acceleration at up to 15 stations,
- (6) lateral acceleration at up to 15 stations.

As the program cycles through the speed, heading and T_0 loops, the rms motions are written on the file PPNAME, the structure of which is given in Table 3. The number of records in PPNAME is five per speed/period/heading combination. For example, for 6 speeds, 13 periods and 13 headings this corresponds to $5 \times 6 \times 13 \times 13 = 5070$ records. For 4 stations, then, the total number of words is 18252.

SWPA also generates the file SHORT.DAT, described in Table 4. The FORTRAN variable names in Table 4 are defined in the Nomenclature.

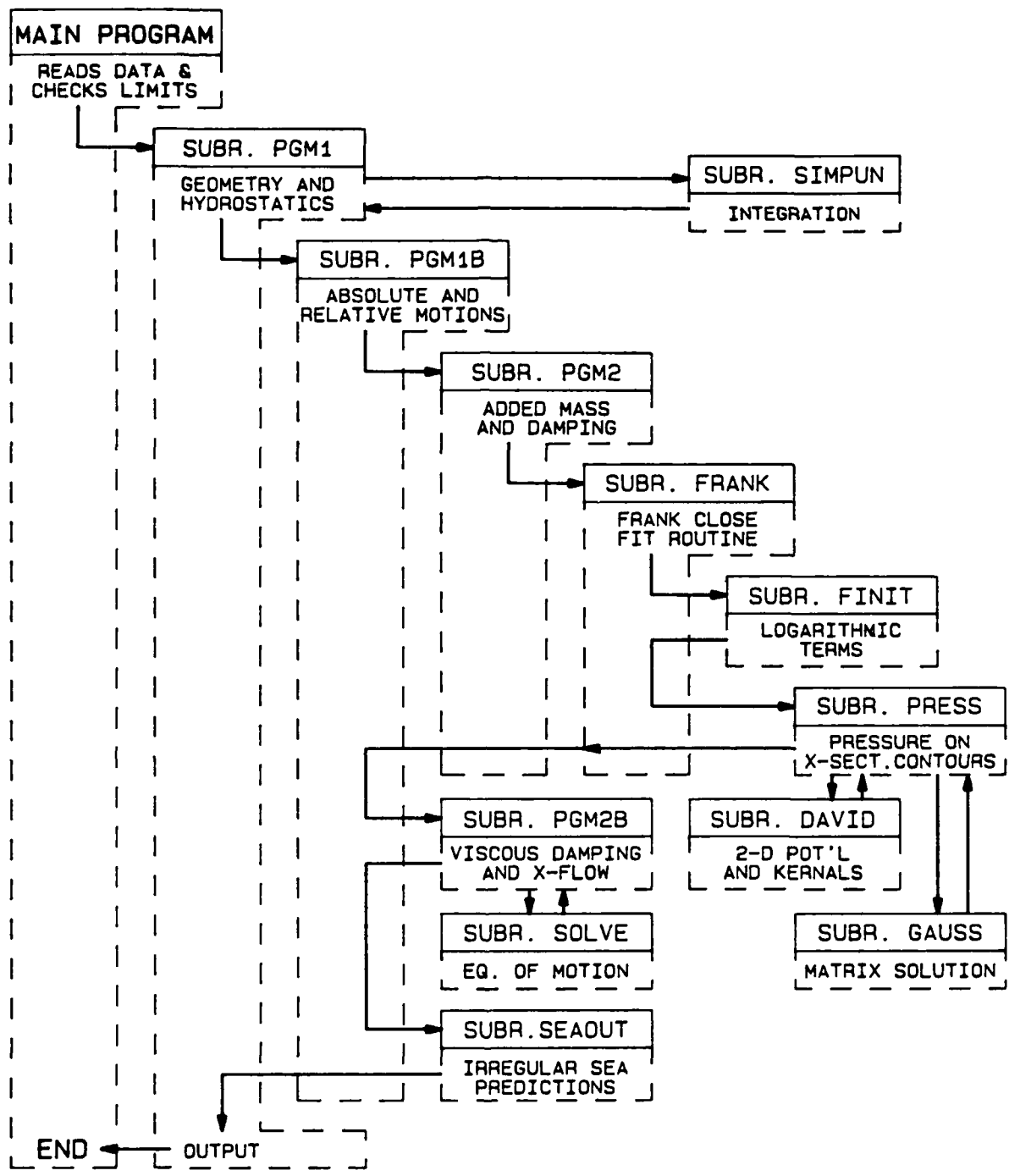


Figure 4: SWPA Flow Chart

3.4 CONVER

CONVER is the computer program which converts the unidirectional sea rms motions in the file Ppname to short-crested rms motions stored in file SCSMOT.DAT.

In addition to Ppname, CONVER requires the file SHORT.DAT whose structure is given in Table 4.

Program CONVER consists of the irregular multidirectional sea, subroutines extracted from SWATM2. The spectral options offered by SWATM2 are retained.

Like SWPA, CONVER writes data for each speed/heading/period combination in the computer disk files RMS and RMSX, with each complete combination being appended to SCSMOT. The rms and rmsx structure remains as given in Table 4. The format of SCSMOT is as for Ppname, as given in Table 3.

3.5 SWSPA

SWSPA is the computer program that takes as input user-specified seakeeping criteria, reads the rms motion data file generated by CONVER, and then performs the seakeeping assessment. A flow chart for SWSPA is given in Figure 5.

The input to SWSPA is as follows:

- (1) rms responses to short crested seas given in SCSMOT.DAT;
- (2) ocean area probability data in the file SEADAT.DAT;
- (3) roll non-linearity corrections in the file SHORT.DAT;
- (4) limits on motions, whether as pitch or roll or accelerations or relative motions at particular stations, given in CKEEP.DAT.

Records 20 and 21 of SHORT.DAT (see Table 4) are user appended variables and are only used by SWSPA. The variable definitions are:

- (1) SP: ship speed in knots, and
- (2) ROCORR: roll non-linearity correction factor, R_c .

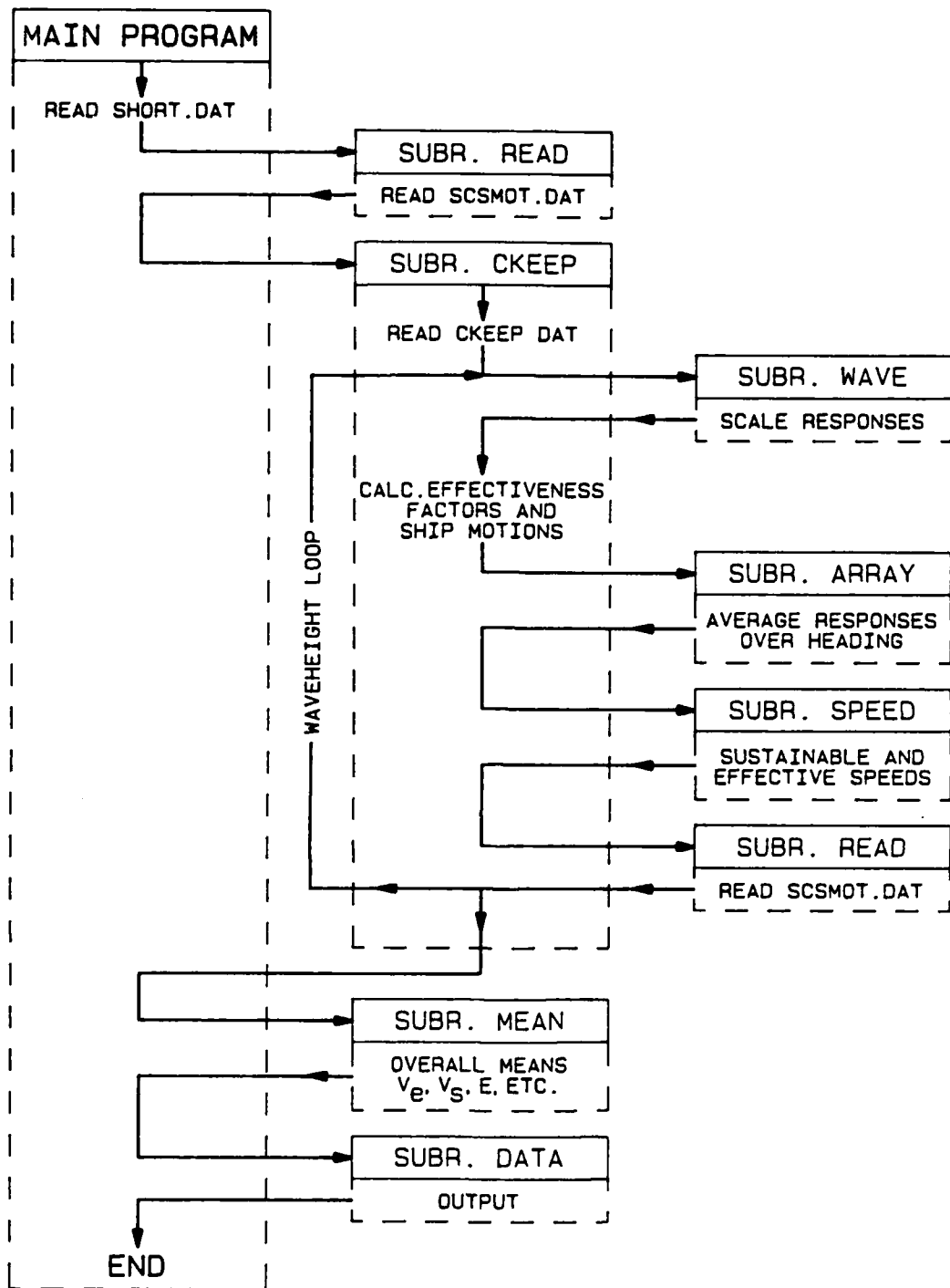


Figure 5: SWSPA Flow Chart

CKEEP.DAT specifies both program controls and response limits. Table 5 gives the file structure. FORTRAN definitions are given in the Nomenclature.

SEADAT.DAT contains the annual percentage occurrence of sea state data, there being NSEA records, each for one wave period. Each record has 13 entries, each corresponding to a waveheight.

3.6 Use of the SWSPA Package

The User's Manual for the SWSPA package is given in Appendix A, and a sample case is given in Appendix B.

The files generated by the SWSPA package are particularly large and users may encounter system account difficulties if several cases are run consecutively without first deleting or archiving files from earlier runs. Similarly, execution times may require running cases in batch mode: on DREA's DEC-20, SWPA runs are aborted by the operating system if the user attempts to run cases interactively.

4. CONCLUDING REMARKS

A computer program package has been developed for the seakeeping performance assessment of SWATH ships. This package, given the name SWSPA (SWATH Seakeeping Performance Assessment) is based on an existing ship motion computer program, SWATM2, and a recently published North Atlantic data base. SWSPA consists of four programs:

SWATM2 is used to check input data and to compute factors to compensate for roll non-linearities.

SWPA uses the data file to generate a data file of rms motions in long-crested irregular waves for a user specified speed range, number of headings to the seas, (typically 13), and number of modal wave periods (typically 13).

CONVER uses the rms motions calculated by SWPA and calculates rms motions in multi-directional seas with a user specified spreading angle.

SWSPA uses the multi-directional motions data, together with specified ocean area data and then applies seakeeping criteria to compute such seakeeping performance parameters as sustainable speed and effective speed. These are then averaged over headings to obtain mean values for each sea condition. Finally, averages

over all sea conditions for the specified ocean area are computed by weighting each sea condition in accordance with its percentage of occurrence. An important output is the ocean area operational fraction, which, for a given speed, is the fraction of headings and sea conditions for which limits on slamming, deck wetness and motions are not exceeded and operational effectiveness is acceptable.

A user's manual for SWSPA has been presented, including descriptions of program structure, input and output. Input and output examples have also been given.

TABLE 2: OVERALL SEAKEEPING PERFORMANCE FOR NORTH ATLANTIC OCEAN

OVERALL SEAKEEPING PERFORMANCE

MEAN SUSTAINABLE SPEED = 30.0

MEAN EFFECTIVE SPEED = 29.30

SPEED (KT)	VERT. ACC.	EFFECTIVENESS FACTORS (PERCENT)			FRACTION
		LAT. ACC	ROLL	OVER-ALL	
5.0	99.7	91.1	100.0	91.1	.937
10.0	99.7	91.5	100.0	91.5	.942
15.0	99.6	92.1	100.0	92.1	.952
20.0	99.6	92.7	100.0	92.7	.964
25.0	99.5	93.3	100.0	93.3	.970
30.0	99.4	93.9	100.0	93.9	.977

TABLE 3: STRUCTURE OF FILE PNAME IN SWATH PACKAGE

Record Number	
1 - 5	motion block for JS = 1, MM = 1
6 - 10	2
11 - 15	3
16 - 20	4
21 - 25	5
26 - 30	6
31 - 35	7
36 - 40	8
41 - 45	9
46 - 50	10
51 - 55	11
56 - 60	12
61 - 65	13
66 - 130	motion blocks for JS = 2, MM = 1 - 13
131 - 195	3
196 - 260	4
261 - 325	5
326 - 390	6
391 - 455	7
456 - 520	8
521 - 585	9
586 - 650	10
651 - 715	11
716 - 780	12
781 - 845	13

Note: (1) An individual motion block consists of 5 records with the following data:

- Record 1 pitch and roll;
- Record 2 relative motion at specified stations;
- Record 3 relative velocity at specified stations;
- Record 4 vertical acceleration at specified stations; and
- Record 5 lateral acceleration at specified stations.

(2) This table applies to one speed and four specified stations.

(3) JS is the sea state index, JS=1, no. of periods. MM is the sea direction index, MM=1, no. of headings.

TABLE 4: STRUCTURE OF FILE SHORT.DAT

RECORD OF CONTENTS

Record
Number

1. spread, NFN, NSTR, NBTA, NSEA, DEPCAT, SD, EXPMAK, NUN.

2. SINBET, COSBET, WANG for first heading.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14. SINBET, COSBET, WANG for thirteenth heading.

15. RBMST, RBMHT, FREEB, BXCL, DRST, ZPOS for first station.

16.

17.

18. RBMST, RBMHT, FREEB, BXCL, DRST, ZPOS for fourth station.

19. TSW(LL), LL = 1, NSEA.

20. SP(JJ), JJ = 1, NFN.

21. ROCORR(JJ), JJ = 1, NFN.

Note: This table applies to 13 headings and 4 stations. Records 20, 21 are user appended to file.

TABLE 5: STRUCTURE OF FILE CKEEP.DAT

<u>Record Number</u>	<u>RECORD OF CONTENTS</u>
1	HREF
2	ITERM, IPRINT, IMEAN
3	PDW, PITCH, ROLL
4-(NSTR+3)	AVMX(I), ALMX(I)
NSTR+4	AVMAX, AVMIN, ALMAX, ALMIN, RMAX, RMIN
NSTR+5	EFFMIN
NSTR+6	NUM
NSTR+7	H(I), I+1, NUM

APPENDIX A: USER'S MANUAL FOR THE SWSPA PACKAGE

A.1 Input

A.1.1 SWATM2

SWATM2 is used in the SWSPA package in order to check input data and to enable calculation of roll non-linearity correction factors for inclusion in the file SHORT.DAT and use by the program SWSPA.

For data checking, SWATM2 may be run simply to output the input data by setting the variable ICHECK in record 2 equal to 1 (see Reference 1). A zero value of ICHECK allows program execution.

To generate data for calculation of roll non-linearity correction factors, a run (or runs as SWATM2 is limited to four speeds out of consideration of file size) is made for beam seas ($\beta = 90$ degrees) with significant waveheights of HREF and 2 X HREF. The appropriate wave spectrum is specified and a suitable value of T_0 for the two waveheights is selected.

Appendix B includes a SWATM2 input example, together with the corresponding output.

A.1.2. SWPA

Input requirements for SWPA differ little from SWATM2, so only those input records differing from SWATM2 will be described.

Record (2), 7 integers

IFIN: IFIN = 0 = > ship has no motion control fins.
IFIN = 1 = > ship has fins.

NUN: NUN = 1 = > British units input and output.
NUN = 2 = > Metric units input and output.

LX: controls output of naked hull added mass and damping coefficients.
LX = 0 = > no output of coefficients.
LX = 0 = > coefficients output to disc file HULL.DAT.
LX = 2 = > coefficients output to line printer.

IEQ: controls output of equation of motions solved, exciting forces and damping coefficients.
IEQ = 0 = > no output.
IEQ = 1 = > output to line printer.

IREG: IREG = 0 = > no output of regular wave responses.
IREG = 1 = > output of regular wave responses to line printer.

ICHECK: execution control.
ICHECK = 0 = > normal program execution.
ICHECK = 1 = > printout of input data with further execution suppressed.

ISAVE: ISAVE = 0 = > program calculates naked hull added mass and damping coefficients.
ISAVE = 1 = > program reads naked hull added mass and damping coefficients from file HULL.DAT.

Record 3 is the same as for SWATM2, but the maximum allowable value for NFN is increased to 6 from 4.

Note that in Records 15 and 18, it is necessary to input NSEA sea states, each of HREF height, with various periods, generally 13 in number. Similarly, although SWPA is a long-crested sea model, the spreading angle called for in record 17 must be input. This number is simply output to SHORT.DAT for eventual use by the program CONVER.

A typical example of input is given in Appendix B.

There are two output files generated by SWPA: SHORT.DAT and PPNNAME. Examples corresponding to the preceding input are given in Appendix B.

A.1.3 CONVER

No data, other than SWPA output is required to run CONVER. Output is the file SCSTMOT.DAT, an example of which is shown in Appendix B.

A.1.4 SWSPA

Input required by SWSPA is comprised of a number of files. One of these, SCSTMOT.DAT, is produced by CONVER in a ready to use state.

SHORT.DAT

The bulk of SHORT.DAT is produced by SWPA, but the last two records are user appended:

penultimate record/NFN reals:

SP(JJ) speeds (in knots) corresponding to the Froude numbers specified in SWPA.

last record, NFN reals

ROCORR(JJ) roll non-linearity correction factor, R_c , in equation (2), Section 3.2.

CKEEP.DAT

The format of file CKEEP.DAT has already been described in detail.

SEADAT.DAT

SEADAT.DAT is a 13 X 13 matrix of waveheight-period combination probabilities, with records as follows:

record 1, 13 reals: K = 1

PB(JS,K) JS = 1, 13, with PB(JS, 1) being the probability of occurrence of a wave period (JS index) at the first waveheight required.

records 2-13, 13 reals: K = 2-13

PB(JS,K) probabilities for subsequent waveheights.

A.2 Output

Output for SWATM2 has been adequately described elsewhere and will not be described here, other than by reference to Appendix B.

The various files created by programs SWPA and CONVER have already been described. They are not output by the programs, but may be printed by the user if required.

The output of SWSPA is controlled by the file CKEEP.DAT. The integer IPRINT would normally be set to zero to suppress the writing of the array PERF on file CHECK.DAT. Appendix B shows an example of this array. The integer IMEAN, set to zero, writes both effectiveness arrays and the performance summary onto a file OUTPUT.DAT, as shown in Appendix B. Setting IMEAN to 1 will allow the writing to OUTPUT.DAT of only the performance summary, as shown in Table 2.

APPENDIX B: SAMPLE INPUTS AND OUTPUTS FOR THE SWSPA PACKAGE

The example given herein calculates the performance of a 4921 ton (5000 tonne) SWATH frigate in North Atlantic conditions, as given in Table 1.

The first input and output listings, labelled Annex 1 and Annex 2, are for SWATH2 at three of the six speeds (5, 10, ..., 30 kt) specified and are used to calculate the variable ROCORR, as below:

Speed, kt:	5	10	15	20	25	30
ROCORR	1.371	1.361	1.351	1.348	1.338	1.326

The third listing, Annex 3, is the input file for SWPA. This is followed by an abbreviated version of the output file PPNAME, Annex 4. The full listing of PPNAME in this case would take 84 line-printer pages. Annex 5, SHORT.DAT, is also produced by SWPA, but in this case is shown with the user appended variables, SP and ROCORR, added.

The sixth listing, Annex 6, is an abbreviated version of SCSTMOT.DAT, the output file from the program CONVER. This file's format is as for PPNAME, but the data are for short-crested rather than long-crested seas.

Annexes 7 and 8 are the user-typed files SEADAT.DAT and CKEEP.DAT, which define ocean area probabilities and motions limits respectively. These files are required, together with SCSTMOT.DAT and SHORT.DAT, as input to SWSPA.

The final listing, Annex 9, gives the output file from SWSPA. In this particular case, with the limits selected, mean sustainable and effective speeds are both very high, 30.0 and 29.30 knots respectively. These high speeds are typical of SWATH ships. A typical monohull might have mean sustainable and effective speeds of 27.0 and 23.7 knots.

ANNEX 1

SWATH OPTION C4(2): 4921 TON FFH

```

1 1 0 0 0 0
25 7 3 25 6 30 3
0.5 3.0
0.0 30.0 60.0 90.0 120.0 150.0 180.0
0.48940 0.53834 0.58726
41.11
-0.8990 -0.4322 4.3221 11.3000 15.8620 18.6282
0.30 6.30 6.30 6.30 6.30 6.30
231.37 0.321 0.35 11.30 -6.30 11.10 19.06
20.0 27.24 19.06 9.25 11.50 1.50 4.50 1.20
227.0 22.36 19.06 15.75 19.50 1.50 4.50 1.20
0.5 0.07
1
3
60.0
9.84 8.94
16.40 9.74
22.97 10.39
40.50 18.50
40.50 18.50
40.50 18.50
40.50 18.50
40.50 18.50
40.50 18.50
-2.5 7 0
-2.0 7 0
-1.0 7 0
0.0 7 0
1.0 11 0
2.0 11 0
3.0 11 0
4.0 11 0
5.0 11 0
6.0 11 0
7.0 11 0
8.0 11 0
9.0 11 2
10.0 11 1
11.0 11 1
12.0 11 0
13.0 11 0
14.0 11 0
15.0 11 0
16.0 11 0
17.0 11 0
18.0 11 0
19.0 11 0
20.0 7 0
21.0 7 0
22.0 7 0
23.0 7 0
24.0 7 0
25.0 7 0
26.0 7 0

```

SWATM2 INPUT (1 of 2)

ANNEX 1

0.00 -2.00 -2.00 0.00 2.00 2.00 0.00
 12.55 11.05 8.05 6.55 8.05 11.05 12.55
 0.00 -5.03 -5.03 0.00 5.03 5.03 0.00
 16.05 12.00 6.30 3.05 6.30 12.00 16.05
 0.00 -7.00 -7.00 0.00 7.00 7.00 0.00
 18.08 14.12 4.99 0.43 4.99 14.12 18.08
 0.00 -8.05 -8.05 0.00 8.05 8.05 0.00
 18.85 14.20 4.90 0.25 4.90 14.20 18.85
 -2.50 -2.50 -2.50 -0.19 -7.03 0.00 7.03 0.19 2.50 2.50 2.50
 28.61 23.22 17.83 12.34 4.51 0.90 4.51 12.34 17.83 23.22 28.61
 -3.10 -3.10 -3.10 -7.05 -6.45 0.00 6.45 7.05 3.10 3.10 3.10
 28.61 22.84 17.07 11.66 4.61 1.43 4.61 11.66 17.07 22.84 28.61
 -3.55 -3.55 -3.55 -7.93 -6.35 0.00 6.35 7.93 3.55 3.55 3.55
 28.61 22.74 16.86 11.35 4.48 1.43 4.48 11.35 16.86 22.74 28.61
 -3.90 -3.90 -3.90 -7.98 -6.26 0.00 6.26 7.98 3.90 3.90 3.90
 28.61 22.65 16.68 11.09 4.38 1.43 4.38 11.09 16.68 22.65 28.61
 -4.10 -4.10 -4.10 -8.01 -6.21 0.00 6.21 8.01 4.10 4.10 4.10
 28.61 22.59 16.57 10.94 4.32 1.43 4.32 10.94 16.57 22.59 28.61
 -4.30 -4.30 -4.30 -8.03 -6.16 0.00 6.16 8.03 4.30 4.30 4.30
 28.61 22.53 16.45 10.78 4.26 1.43 4.26 10.78 16.45 22.53 28.61
 -4.38 -4.38 -4.38 -8.04 -6.15 0.00 6.15 8.04 4.38 4.38 4.38
 28.61 22.51 16.40 10.73 4.24 1.43 4.24 10.73 16.40 22.51 28.61
 -4.45 -4.45 -4.45 -8.05 -6.13 0.00 6.13 8.05 4.45 4.45 4.45
 28.61 22.48 16.35 10.67 4.22 1.43 4.22 10.67 16.35 22.48 28.61
 -4.50 -4.50 -4.50 -8.05 -6.11 0.00 6.11 8.05 4.50 4.50 4.50
 28.61 22.47 16.32 10.63 4.20 1.43 4.20 10.63 16.32 22.47 28.61
 -4.50 -4.50 -4.50 -8.05 -6.11 0.00 6.11 8.05 4.50 4.50 4.50
 28.61 22.47 16.32 10.63 4.20 1.43 4.20 10.63 16.32 22.47 28.61
 -4.50 -4.50 -4.50 -8.05 -6.11 0.00 6.11 8.05 4.50 4.50 4.50
 28.61 22.47 16.32 10.63 4.20 1.43 4.20 10.63 16.32 22.47 28.61
 -4.45 -4.45 -4.45 -8.05 -6.13 0.00 6.13 8.05 4.45 4.45 4.45
 28.61 22.48 16.35 10.67 4.22 1.43 4.22 10.67 16.35 22.48 28.61
 -4.25 -4.25 -4.25 -8.03 -6.18 0.00 6.18 8.03 4.25 4.25 4.25
 28.61 22.55 16.48 10.82 4.26 1.43 4.26 10.82 16.48 22.55 28.61
 -4.00 -4.00 -4.00 -7.99 -6.24 0.00 6.24 7.99 4.00 4.00 4.00
 28.61 22.62 16.63 11.01 4.35 1.43 4.35 11.01 16.63 22.62 28.61
 -3.70 -3.70 -3.70 -7.95 -6.31 0.00 6.31 7.95 3.70 3.70 3.70
 28.61 22.70 16.79 11.24 4.44 1.43 4.44 11.24 16.79 22.70 28.61
 -3.25 -3.25 -3.25 -7.87 -6.41 0.00 6.41 7.87 3.25 3.25 3.25
 28.61 22.81 17.00 11.56 4.57 1.43 4.57 11.56 17.00 22.81 28.61
 -2.70 -2.70 -2.70 -7.77 -6.53 0.00 6.53 7.77 2.70 2.70 2.70
 28.61 22.92 17.22 11.84 4.73 1.43 4.73 11.84 17.22 22.92 28.61
 -2.00 -2.00 -2.00 -7.61 -6.68 0.00 6.68 7.61 2.00 2.00 2.00
 28.61 23.02 17.43 12.40 4.92 1.43 4.92 12.40 17.43 23.02 28.61
 -1.18 -1.18 -1.18 -7.05 -7.29 0.00 7.29 7.05 1.18 1.18 1.18
 28.61 23.37 18.12 13.18 4.89 0.90 4.89 13.18 18.12 23.37 28.61
 0.00 -8.05 -8.05 0.00 8.05 8.05 0.00
 18.85 14.20 4.90 0.25 4.90 14.20 18.85
 0.00 -8.12 -8.12 0.00 8.12 8.12 0.00
 18.92 14.23 4.86 0.17 4.86 14.23 18.92
 0.00 -7.49 -7.49 0.00 7.49 7.49 0.00
 18.20 13.88 5.23 0.90 5.23 13.88 18.20
 0.00 -6.52 -6.52 0.00 6.52 6.52 0.00
 17.08 13.32 5.79 2.03 5.79 13.32 17.08
 0.00 -5.00 -5.00 0.00 5.00 5.00 0.00
 15.32 12.43 6.66 3.77 6.66 12.43 15.32
 0.00 -2.86 -2.86 0.00 2.86 2.86 0.00
 12.85 11.20 7.90 6.25 7.90 11.20 12.85
 0.00 -0.89 -0.89 0.00 0.89 0.89 0.00
 9.65 9.00 9.50 9.45 9.50 9.00 9.65

SWATM2 INPUT (2 of 2)

SWATMO SHIP MOTIONS OF SWATH OPTION C4(2): 4921 TON FFH
 SYSTEM OF UNITS USED : BRITISH

PAGE 1

SWATH OPTION C4(2): 4921 TON FFH

1	1	0	0	0	0				
25	7	3	25	6	30	3			
0.50000	3.00000								
0.00000	30.00000	60.00000	90.00000	120.00000	150.00000	180.00000			
0.48940	0.53034	0.56728							
41.11000									
-0.80900	-0.43220	4.32210	11.30000	15.86200	18.62020				
6.30000	6.30000	6.30000	6.30000	6.30000	6.30000				
231.37000	0.32100	0.35000	11.30000	-6.30000	11.10000	19.06000			
20.00000	27.24000	19.06000	9.25000	11.50000	1.50000	4.50000	1.20000		
227.00000	22.36000	19.06000	15.75000	19.50000	1.50000	4.50000	1.20000		
0.50000	0.07000								
1									
3									
60.0000									
9.8400	0.9400								
16.4000	9.7400								
22.9700	10.3900								
40.50000	18.50000								
40.50000	18.50000								
40.50000	18.50000								
40.50000	18.50000								
40.50000	18.50000								
40.50000	18.50000								
-2.5000	7	0							
-2.0000	7	0							
-1.0000	7	0							
0.0000	7	0							
1.0000	11	0							
2.0000	11	0							
3.0000	11	0							
4.0000	11	0							
5.0000	11	0							
6.0000	11	0							
7.0000	11	0							
8.0000	11	0							
9.0000	11	2							
10.0000	11	1							
11.0000	11	1							
12.0000	11	0							
13.0000	11	0							
14.0000	11	0							
15.0000	11	0							
16.0000	11	0							
17.0000	11	0							
18.0000	11	0							
19.0000	11	0							
20.0000	7	0							
21.0000	7	0							
22.0000	7	0							
23.0000	7	0							
24.0000	7	0							
25.0000	7	0							
26.0000	7	0							

PARTIAL SWATM2 OUTPUT (1 of 7)

SWATMO SHIP MOTIONS OF SWATH OPTION C4(2): 4921 TON FFH

PAGE 2

STATION -2.5000
 0.0000 -2.0000 -2.0000 0.0000 2.0000 2.0000 0.0000
 12.5500 11.0500 8.0500 6.5500 8.0500 11.0500 12.5500

STATION -2.0000
 0.0000 -5.6300 -5.6300 0.0000 5.6300 5.6300 0.0000
 16.0500 12.0000 6.3000 3.0500 6.3000 12.0000 16.0500

STATION -1.0000
 0.0000 -7.9000 -7.9000 0.0000 7.9000 7.9000 0.0000
 18.6800 14.1200 4.9900 6.4300 4.9900 14.1200 18.6800

STATION 0.0000
 0.0000 -8.0500 -8.0500 0.0000 8.0500 8.0500 0.0000
 18.8500 14.2000 4.9000 6.2500 4.9000 14.2000 18.8500

STATION 1.0000
 -2.5000 -2.5000 -2.5000 -8.1900 -7.0300 0.0000 7.0300 8.1900 2.5000 2.5000
 28.6100 23.2200 17.8300 12.3400 4.5100 0.9000 4.5100 12.3400 17.8300 23.2200
 28.6100

STATION 2.0000
 -3.1000 -3.1000 -3.1000 -7.8500 -6.4500 0.0000 6.4500 7.8500 3.1000 3.1000
 28.6100 22.8400 17.0700 11.6000 4.6100 1.4300 4.6100 11.6000 17.0700 22.8400
 28.6100

STATION 19.0000
 -1.1800 -1.1800 -1.1800 -7.0500 -7.2900 0.0000 7.2900 7.0500 1.1800 1.1800
 28.6100 23.3700 18.1200 13.1800 4.8900 0.0000 4.8900 13.1800 18.1200 23.3700
 28.6100

STATION 20.0000
 0.0000 -8.0500 -8.0500 0.0000 8.0500 8.0500 0.0000
 18.8500 14.2000 4.9000 6.2500 4.9000 14.2000 18.8500

STATION 23.0000
 0.0000 -6.5200 -6.5200 0.0000 6.5200 6.5200 0.0000
 17.0800 13.3200 5.7900 2.0300 5.7900 13.3200 17.0800

STATION 24.0000
 0.0000 -5.0000 -5.0000 0.0000 5.0000 5.0000 0.0000
 15.3200 12.4300 6.6600 3.7700 6.6600 12.4300 15.3200

STATION 25.0000
 0.0000 -2.8600 -2.8600 0.0000 2.8600 2.8600 0.0000
 12.8500 11.2000 7.9000 6.2500 7.9000 11.2000 12.8500

STATION 26.0000
 0.0000 -0.0900 -0.0900 0.0000 0.0900 0.0900 0.0000
 9.6500 9.0000 9.5000 9.4500 9.5000 9.0000 9.6500

PARTIAL SWATM2 OUTPUT (2 of 7)

SWATMO SHIP MOTIONS OF SWATH OPTION C4(2): 4921 TON FPM

PAGE 5

STATION	BEAM	DRAFT	AREA	COEFFICIENT
-2.5000	0.0000	6.0000	0.7704	
-2.0000	0.0000	13.0000	0.7699	
-1.0000	0.0000	18.2500	0.7698	
0.0000	0.0000	18.6000	0.7694	
1.0000	5.0000	27.7100	1.9907	
2.0000	6.2000	27.1000	1.5857	
3.0000	7.1000	27.1800	1.4431	
4.0000	7.8000	27.1000	1.3545	
5.0000	8.2000	27.1000	1.3117	

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22.0000	0.0000	17.3000	0.7697	
23.0000	0.0000	15.0500	0.7705	
24.0000	0.0000	11.5500	0.7692	
25.0000	0.0000	6.6000	0.7704	
26.0000	0.0000	0.2000	0.8000	

CRITICAL ENC. FREQ. FOR STATION -2.5000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION -2.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION -1.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 0.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 1.0000 = 12.0571
 CRITICAL ENC. FREQ. FOR STATION 2.0000 = 10.0276
 CRITICAL ENC. FREQ. FOR STATION 3.0000 = 10.1181
 CRITICAL ENC. FREQ. FOR STATION 4.0000 = 9.6534
 CRITICAL ENC. FREQ. FOR STATION 5.0000 = 9.4150
 CRITICAL ENC. FREQ. FOR STATION 6.0000 = 9.1935
 CRITICAL ENC. FREQ. FOR STATION 7.0000 = 9.1091
 CRITICAL ENC. FREQ. FOR STATION 8.0000 = 9.0372
 CRITICAL ENC. FREQ. FOR STATION 9.0000 = 8.9868
 CRITICAL ENC. FREQ. FOR STATION 10.0000 = 8.9868
 CRITICAL ENC. FREQ. FOR STATION 11.0000 = 8.9868
 CRITICAL ENC. FREQ. FOR STATION 12.0000 = 9.0372
 CRITICAL ENC. FREQ. FOR STATION 13.0000 = 9.2474
 CRITICAL ENC. FREQ. FOR STATION 14.0000 = 9.5320
 CRITICAL ENC. FREQ. FOR STATION 15.0000 = 9.9109
 CRITICAL ENC. FREQ. FOR STATION 16.0000 = 10.5748
 CRITICAL ENC. FREQ. FOR STATION 17.0000 = 11.6020
 CRITICAL ENC. FREQ. FOR STATION 18.0000 = 13.4803
 CRITICAL ENC. FREQ. FOR STATION 19.0000 = 17.5498
 CRITICAL ENC. FREQ. FOR STATION 20.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 21.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 22.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 23.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 24.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 25.0000 = 0.0000
 CRITICAL ENC. FREQ. FOR STATION 26.0000 = 0.0000

MINIMUM CRITICAL ENC. FREQ. = 0.0000 DUE TO STATION 26.0000

PARTIAL SWATM2 OUTPUT (3 of 7)

SWATMO SHIP MOTIONS OF SWATH OPTION C4(2): 4921 TON FPH

PAGE 6

DATA FOR ONE HULL

LENGTH BETWEEN PERPENDICULARS = 231.37000 FEET
 BEAM AT MIDSHIP = 9.00000 FEET
 DRAFT AT MIDSHIP = 27.10000 FEET
 DISPLACEMENT = 2289.687 LONG TONS
 BLOCK COEFFICIENT = 1.45225
 LONGITUDINAL CENTER OF BUOYANCY = 123.75142 FEET AFT OF F.P.
 LONGITUDINAL CENTER OF BUOYANCY = 10.69727 STATIONS
 GIVEN CENTER OF BUOYANCY = 11.30000 STATIONS
 LONGITUDINAL CENTER OF FLOTATION = 110.30519 FEET AFT OF F.P.
 LONGITUDINAL CENTER OF FLOTATION = 9.53496 STATIONS
 VERTICAL CENTER OF BUOYANCY = 16.27842 FEET FROM THE DESIGNED LOAD WATERLINE
 RADIUS OF GYRATION/L.B.P. = 0.32100
 TRANSVERSE METACENTRIC HEIGHT = 11.10000 FEET
 BEAM/DRAFT = 0.33113
 LENGTH/BEAM = 25.70778

THE HEAVE-HEAVE RESTORING COEFFICIENT IS 4.46348
 THE HEAVE-PITCH RESTORING COEFFICIENT IS -0.39568
 THE PITCH-PITCH RESTORING COEFFICIENT IS 0.19438

PROJECTED AREA OF THE SUBMERGED HULL/L**2 = 0.911284E-01
 MOMENT/L**3 = -0.111127E-02 MOMENT OF INERTIA/L**4 = 0.134836E-01

HULL SEPARATION/BEAM = 8.1356

PARTIAL SWATM2 OUTPUT (4 of 7)

RMS MOTIONS IN UNIDIRECTIONAL SEAS

SPEED = 25.0 KNOTS FROUDE NO = 0.489

SEA STATE = 5 SIG WAVE HT = 9.8400 FEET WAVE PERIOD = 9.9400 SEC

HEADING (DEG)	SWAY ACC (G)	HEAVE (F)	HEAVE ACC (G)	ROLL (DEG)	PITCH (DEG)	YAW (DEG)
0.0	0.000	0.231	0.000	0.001	0.071	0.023
30.0	0.000	0.279	0.000	0.018	0.211	0.205
60.0	0.001	0.277	0.001	0.024	0.279	0.521
90.0	0.013	0.293	0.004	0.034	0.067	0.419
120.0	0.194	0.341	0.008	0.099	0.204	5.097
150.0	0.035	0.333	0.013	0.046	0.296	1.204
180.0	0.001	0.334	0.016	0.001	0.316	0.032

STATION = -0.8990 Z = 0.0000 F

HEADING	*****VERTICAL*****					VRQI	SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER
DEG	MOT	VEL	ACC	REL	MOT	REL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR
	F	F/SEC	G	F	F/SEC	F	G						
0.0	0.312	0.007	0.002	2.363	0.612	0.002	0.000	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.306	0.063	0.001	2.107	0.423	0.000	0.000	0.0000	0.0	0.0000	0.0	0.0000	0.0
60.0	0.406	0.181	0.002	2.141	0.774	0.002	0.006	0.0000	0.0	0.0000	0.0	0.0000	0.0
90.0	0.237	0.165	0.004	2.216	1.748	0.004	0.036	0.0000	0.0	0.0000	0.0	0.0000	0.0
120.0	0.671	0.750	0.029	2.727	3.274	0.034	0.536	0.0000	0.0	0.0000	0.0	0.0000	0.0
150.0	0.556	0.834	0.047	2.445	3.705	0.050	0.168	0.0000	0.0	0.0000	0.0	0.0000	0.0
180.0	0.562	0.960	0.063	2.456	4.207	0.066	0.005	0.0000	0.0	0.0000	0.0	0.0000	0.0

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STATION = 11.3000 Z = 0.0000 F

HEADING	*****VERTICAL*****					VRQI	SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER
DEG	MOT	VEL	ACC	REL	MOT	REL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR
	F	F/SEC	G	F	F/SEC	F	G						
0.0	0.229	0.032	0.000	2.059	0.530	0.000	0.000	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.301	0.058	0.000	2.020	0.394	0.000	0.000	0.0000	0.0	0.0000	0.0	0.0000	0.0
60.0	0.303	0.109	0.001	2.066	0.743	0.001	0.001	0.0000	0.0	0.0000	0.0	0.0000	0.0
90.0	0.298	0.182	0.004	2.126	1.688	0.004	0.012	0.0000	0.0	0.0000	0.0	0.0000	0.0
120.0	0.334	0.283	0.008	2.155	2.679	0.009	0.195	0.0000	0.0	0.0000	0.0	0.0000	0.0
150.0	0.356	0.382	0.015	2.175	3.389	0.016	0.030	0.0000	0.0	0.0000	0.0	0.0000	0.0
180.0	0.362	0.425	0.018	2.136	3.594	0.020	0.001	0.0000	0.0	0.0000	0.0	0.0000	0.0

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STATION = 18.0282 Z = 0.0000 F

HEADING	*****VERTICAL*****					VRQI	SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER
DEG	MOT	VEL	ACC	REL	MOT	REL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR
	F	F/SEC	G	F	F/SEC	F	G						
0.0	0.235	0.060	0.001	2.175	0.561	0.001	0.000	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.590	0.115	0.001	1.950	0.386	0.000	0.000	0.0000	0.0	0.0000	0.0	0.0000	0.0
60.0	0.678	0.248	0.003	1.681	0.594	0.002	0.004	0.0000	0.0	0.0000	0.0	0.0000	0.0
90.0	0.366	0.222	0.004	2.076	1.855	0.005	0.020	0.0000	0.0	0.0000	0.0	0.0000	0.0
120.0	0.306	0.430	0.017	2.202	2.843	0.020	0.377	0.0000	0.0	0.0000	0.0	0.0000	0.0
150.0	0.727	0.941	0.045	2.733	4.069	0.050	0.077	0.0000	0.0	0.0000	0.0	0.0000	0.0
180.0	0.775	1.089	0.060	2.787	4.445	0.064	0.003	0.0000	0.0	0.0000	0.0	0.0000	0.0

PARTIAL SWATM2 OUTPUT (5 of 7)

SWATMO SHIP MOTIONS OF SWATH OPTION C4(2): 4921 TON FPH
 RMS MOTIONS IN SHORT-CRESTED SEAS - SPREADING ANGLE = 60.00 DEG

SPEED = 25.0 KNOTS FROUDE NO = 0.489

SEA STATE = 5 SIG WAVE HT = 9.8400 FEET WAVE PERIOD = 8.9400 SEC

HEADING (DEG)	SWAY ACC (G)	HEAVE (F)	HEAVE ACC (G)	ROLL (DEG)	PITCH (DEG)	YAW (DEG)
0.0	0.002	0.261	0.000	0.013	0.163	0.181
30.0	0.004	0.270	0.001	0.017	0.210	0.328
60.0	0.025	0.282	0.002	0.027	0.222	0.716
90.0	0.092	0.302	0.005	0.055	0.172	2.425
120.0	0.129	0.327	0.009	0.074	0.210	3.422
150.0	0.098	0.335	0.013	0.059	0.201	2.636
180.0	0.029	0.334	0.015	0.024	0.310	0.836

STATION = -0.8990 Z = 0.0000 F

HEADING	*****VERTICAL*****			VRM		SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER	
DEG	MOT	VEL	ACC	REL	MOT	REL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR
	F	F/SEC	G	F	F/SEC	G							
0.0	0.303	0.072	0.001	2.207	0.498	0.001	0.005	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.357	0.106	0.001	2.168	0.573	0.001	0.011	0.0000	0.0	0.0000	0.0	0.0000	0.0
60.0	0.389	0.165	0.004	2.155	1.071	0.004	0.066	0.0000	0.0	0.0000	0.0	0.0000	0.0
90.0	0.432	0.396	0.015	2.335	2.086	0.017	0.255	0.0000	0.0	0.0000	0.0	0.0000	0.0
120.0	0.554	0.678	0.031	2.533	3.111	0.035	0.367	0.0000	0.0	0.0000	0.0	0.0000	0.0
150.0	0.587	0.847	0.048	2.517	3.766	0.051	0.290	0.0000	0.0	0.0000	0.0	0.0000	0.0
180.0	0.557	0.921	0.059	2.447	4.083	0.062	0.102	0.0000	0.0	0.0000	0.0	0.0000	0.0

STATION = 11.3000 Z = 0.0000 F

HEADING	*****VERTICAL*****			VRM		SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER	
DEG	MOT	VEL	ACC	REL	MOT	REL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR
	F	F/SEC	G	F	F/SEC	G							
0.0	0.274	0.049	0.000	2.035	0.448	0.000	0.002	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.288	0.071	0.001	2.039	0.537	0.001	0.004	0.0000	0.0	0.0000	0.0	0.0000	0.0
60.0	0.301	0.124	0.002	2.070	1.021	0.002	0.025	0.0000	0.0	0.0000	0.0	0.0000	0.0
90.0	0.308	0.200	0.005	2.118	1.834	0.005	0.092	0.0000	0.0	0.0000	0.0	0.0000	0.0
120.0	0.331	0.291	0.009	2.152	2.677	0.011	0.128	0.0000	0.0	0.0000	0.0	0.0000	0.0
150.0	0.352	0.371	0.014	2.181	3.277	0.016	0.097	0.0000	0.0	0.0000	0.0	0.0000	0.0
180.0	0.360	0.413	0.017	2.148	3.538	0.019	0.028	0.0000	0.0	0.0000	0.0	0.0000	0.0

STATION = 18.6282 Z = 0.0000 F

HEADING	*****VERTICAL*****			VRM		SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER	
DEG	MOT	VEL	ACC	REL	MOT	REL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR
	F	F/SEC	G	F	F/SEC	G							
0.0	0.466	0.097	0.001	2.051	0.461	0.001	0.004	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.558	0.151	0.002	1.940	0.496	0.001	0.008	0.0000	0.0	0.0000	0.0	0.0000	0.0
60.0	0.589	0.215	0.003	1.855	0.956	0.003	0.047	0.0000	0.0	0.0000	0.0	0.0000	0.0
90.0	0.469	0.300	0.010	2.020	1.872	0.011	0.178	0.0000	0.0	0.0000	0.0	0.0000	0.0
120.0	0.491	0.570	0.026	2.316	2.978	0.029	0.251	0.0000	0.0	0.0000	0.0	0.0000	0.0
150.0	0.672	0.883	0.044	2.625	3.896	0.048	0.192	0.0000	0.0	0.0000	0.0	0.0000	0.0
180.0	0.766	1.053	0.056	2.778	4.346	0.061	0.059	0.0000	0.0	0.0000	0.0	0.0000	0.0

PARTIAL SWATM2 OUTPUT (6 of 7)

SWATMO SHIP MOTIONS OF SWATH OPTION C4(2): 4921 TON FPH

PAGE 10

RMS MOTIONS IN UNIDIRECTIONAL SEAS

SPEED = 25.0 KNOTS FROUDE NO = 0.489

SEA STATE = 6 SIG WAVE HT = 16.4000 FEET WAVE PERIOD = 9.7400 SEC

HEADING (DEG)	SWAY ACC (G)	HEAVE (F)	HEAVE ACC (G)	ROLL (DEG)	PITCH (DEG)	YAW (DEG)
0.0	0.000	0.420	0.000	0.002	0.114	0.032
30.0	0.000	0.512	0.001	0.026	0.363	0.295
60.0	0.002	0.507	0.002	0.035	0.430	0.735
90.0	0.019	0.526	0.006	0.049	0.114	0.621
120.0	0.268	0.602	0.013	0.138	0.287	7.017
150.0	0.049	0.596	0.020	0.067	0.431	1.096
180.0	0.001	0.594	0.025	0.002	0.468	0.046

STATION = -0.8990 Z = 0.0000 F

HEADING	VERTICAL			VROI		SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER	
DEG	MOT	VEL	ACC	REL.MOT	REL.VEL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR	
	F	F/SEC	G	F	F/SEC	G							
0.0	0.557	0.144	0.002	3.690	0.977	0.003	0.000	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.497	0.103	0.001	3.189	0.681	0.001	0.001	0.0000	0.0	0.0000	0.0	0.0000	0.0
60.0	0.693	0.258	0.003	3.307	1.186	0.002	0.008	0.0000	0.0	0.0000	0.0	0.0000	0.0
90.0	0.386	0.258	0.006	3.403	2.635	0.006	0.055	0.0000	0.0	0.0000	0.0	0.0000	0.0

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SWATMO SHIP MOTIONS OF SWATH OPTION C4(2): 4921 TON FPH

PAGE 11

RMS MOTIONS IN SHORT-CRESTED SEAS - SPREADING ANGLE = 60.00 DEG

SPEED = 25.0 KNOTS FROUDE NO = 0.489

SEA STATE = 6 SIG WAVE HT = 16.4000 FEET WAVE PERIOD = 9.7400 SEC

HEADING (DEG)	SWAY ACC (G)	HEAVE (F)	HEAVE ACC (G)	ROLL (DEG)	PITCH (DEG)	YAW (DEG)
0.0	0.003	0.477	0.001	0.019	0.278	0.256
30.0	0.005	0.494	0.001	0.026	0.345	0.461
60.0	0.034	0.513	0.003	0.039	0.354	0.998
90.0	0.127	0.541	0.008	0.078	0.263	3.347
120.0	0.178	0.582	0.014	0.103	0.303	4.721
150.0	0.135	0.597	0.020	0.083	0.410	3.639
180.0	0.040	0.594	0.024	0.035	0.458	1.162

STATION = -0.8990 Z = 0.0000 F

HEADING	VERTICAL			VROI		SWAY	PROB	DW PER	PROB	KE PER	PROB	BI PER	
DEG	MOT	VEL	ACC	REL.MOT	REL.VEL	ACC	(DW)	HOUR	(KE)	HOUR	(BI)	HOUR	
	F	F/SEC	G	F	F/SEC	G							
0.0	0.513	0.117	0.002	3.385	0.798	0.001	0.007	0.0000	0.0	0.0000	0.0	0.0000	0.0
30.0	0.560	0.159	0.002	3.320	0.899	0.002	0.014	0.0000	0.0	0.0000	0.0	0.0000	0.0

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PARTIAL SWATM2 OUTPUT (7 of 7)

ANNEX 3

SWATH OPTION C4(2): 4921 TON FPM

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1 1 0 0 0 0 0
30 13 0 30 5 30 3
0.5 10.0
0.0 15.0 30.0 45.0 60.0 75.0 90.0 105.0
120.0 135.0 150.0 165.0 180.0
0.09790 0.19580 0.29360 0.39150 0.48940 0.58730
41.11
0.0 4.32 7.67 15.82 18.15
40.5 62.5 40.5 40.5 31.5
231.37 0.321 0.35 11.30 -0.30 11.10 19.06
20.0 27.24 19.06 9.25 11.50 1.50 2.53 1.20
227.0 22.36 19.06 15.75 19.50 1.50 2.27 1.20
0.5 0.07
3
13
0.0
11.483 3.2
11.483 4.8
11.483 6.3
11.483 7.5
11.483 8.8
11.483 9.7
11.483 10.9
11.483 12.4
11.483 13.8
11.483 15.0
11.483 16.4
11.483 18.0
11.483 20.0
40.50 33.00
40.50 18.50
40.50 18.50
40.50 18.50
40.50 18.50
-2.5 7 0
-2.0 7 0
-1.0 7 0
0.0 7 0
1.0 11 0
2.0 11 0
3.0 11 0
4.0 11 0
5.0 11 0
6.0 11 0
7.0 11 0
8.0 11 0
9.0 11 2
10.0 11 1
11.0 11 1
12.0 11 0
13.0 11 0
14.0 11 0
15.0 11 0
16.0 11 0

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SWPA INPUT (1 of 3)

17.0 11 0
 18.0 11 0
 19.0 11 0
 20.0 7 0
 21.0 7 0
 22.0 7 0
 23.0 7 0
 24.0 7 0
 25.0 7 0
 26.0 7 0
 0.00 -2.00 -2.00 0.00 2.00 2.00 0.00
 12.55 11.05 0.05 0.55 0.05 11.05 12.55
 0.00 -5.63 -5.63 0.00 5.63 5.63 0.00
 16.05 12.00 6.30 3.05 6.30 12.00 16.05
 0.00 -7.90 -7.90 0.00 7.90 7.90 0.00
 18.68 14.12 4.99 0.43 4.99 14.12 18.68
 0.00 -8.05 -8.05 0.00 8.05 8.05 0.00
 18.85 14.20 4.90 0.25 4.90 14.20 18.85
 -2.50 -2.50 -2.50 -8.19 -7.03 0.00 7.03 0.19 2.50 2.50 2.50
 28.61 23.22 17.83 12.34 4.51 0.90 4.51 12.34 17.83 23.22 28.61
 -3.10 -3.10 -3.10 -7.85 -6.45 0.00 6.45 7.85 3.10 3.10 3.10
 28.61 22.84 17.07 11.66 4.61 1.43 4.61 11.66 17.07 22.84 28.61
 -3.55 -3.55 -3.55 -7.93 -6.35 0.00 6.35 7.93 3.55 3.55 3.55
 28.61 22.74 16.86 11.35 4.48 1.43 4.48 11.35 16.86 22.74 28.61
 -3.90 -3.90 -3.90 -7.98 -6.26 0.00 6.26 7.98 3.90 3.90 3.90
 28.61 22.65 16.68 11.09 4.38 1.43 4.38 11.09 16.68 22.65 28.61
 -4.10 -4.10 -4.10 -8.01 -6.21 0.00 6.21 8.01 4.10 4.10 4.10
 28.61 22.59 16.57 10.94 4.32 1.43 4.32 10.94 16.57 22.59 28.61
 -4.30 -4.30 -4.30 -8.03 -6.16 0.00 6.16 8.03 4.30 4.30 4.30
 28.61 22.53 16.45 10.78 4.26 1.43 4.26 10.78 16.45 22.53 28.61
 -4.38 -4.38 -4.38 -8.04 -6.15 0.00 6.15 8.04 4.38 4.38 4.38
 28.61 22.51 16.40 10.73 4.24 1.43 4.24 10.73 16.40 22.51 28.61
 -4.45 -4.45 -4.45 -8.05 -6.13 0.00 6.13 8.05 4.45 4.45 4.45
 28.61 22.48 16.35 10.67 4.22 1.43 4.22 10.67 16.35 22.48 28.61
 -4.50 -4.50 -4.50 -8.05 -6.11 0.00 6.11 8.05 4.50 4.50 4.50
 28.61 22.47 16.32 10.63 4.20 1.43 4.20 10.63 16.32 22.47 28.61
 -4.50 -4.50 -4.50 -8.05 -6.11 0.00 6.11 8.05 4.50 4.50 4.50
 28.61 22.47 16.32 10.63 4.20 1.43 4.20 10.63 16.32 22.47 28.61
 -4.50 -4.50 -4.50 -8.05 -6.11 0.00 6.11 8.05 4.50 4.50 4.50
 28.61 22.47 16.32 10.63 4.20 1.43 4.20 10.63 16.32 22.47 28.61
 -4.45 -4.45 -4.45 -8.05 -6.13 0.00 6.13 8.05 4.45 4.45 4.45
 28.61 22.48 16.35 10.67 4.22 1.43 4.22 10.67 16.35 22.48 28.61
 -4.25 -4.25 -4.25 -8.03 -6.18 0.00 6.18 8.03 4.25 4.25 4.25
 28.61 22.55 16.48 10.82 4.28 1.43 4.28 10.82 16.48 22.55 28.61
 -4.00 -4.00 -4.00 -7.99 -6.24 0.00 6.24 7.99 4.00 4.00 4.00
 28.61 22.62 16.63 11.01 4.35 1.43 4.35 11.01 16.63 22.62 28.61
 -3.70 -3.70 -3.70 -7.95 -6.31 0.00 6.31 7.95 3.70 3.70 3.70
 28.61 22.70 16.79 11.24 4.44 1.43 4.44 11.24 16.79 22.70 28.61
 -3.25 -3.25 -3.25 -7.87 -6.41 0.00 6.41 7.87 3.25 3.25 3.25
 28.61 22.81 17.00 11.56 4.57 1.43 4.57 11.56 17.00 22.81 28.61
 -2.70 -2.70 -2.70 -7.77 -6.53 0.00 6.53 7.77 2.70 2.70 2.70
 28.61 22.92 17.22 11.94 4.73 1.43 4.73 11.94 17.22 22.92 28.61
 -2.00 -2.00 -2.00 -7.61 -6.68 0.00 6.68 7.61 2.00 2.00 2.00
 28.61 23.02 17.43 12.40 4.92 1.43 4.92 12.40 17.43 23.02 28.61
 -1.18 -1.18 -1.18 -7.85 -7.29 0.00 7.29 7.85 1.18 1.18 1.18
 28.61 23.37 18.12 13.10 4.89 0.90 4.89 13.10 18.12 23.37 28.61

SWPA INPUT (2 of 3)

0.00	-8.05	-8.05	0.00	8.05	8.05	0.00
18.85	14.20	4.90	0.25	4.90	14.20	18.85
0.00	-8.12	-8.12	0.00	8.12	8.12	0.00
18.92	14.23	4.86	0.17	4.86	14.23	18.92
0.00	-7.49	-7.49	0.00	7.49	7.49	0.00
18.20	13.88	5.23	0.90	5.23	13.88	18.20
0.00	-6.52	-6.52	0.00	6.52	6.52	0.00
17.08	13.32	5.79	2.03	5.79	13.32	17.08
0.00	-5.00	-5.00	0.00	5.00	5.00	0.00
15.32	12.43	6.66	3.77	6.66	12.43	15.32
0.00	-2.86	-2.86	0.00	2.86	2.86	0.00
12.85	11.20	7.90	6.25	7.90	11.20	12.85
0.00	-0.09	-0.09	0.00	0.09	0.09	0.00
9.65	9.60	9.50	9.45	9.50	9.60	9.65

SWPA INPUT (3 of 3)

ANNEX 4

0.000	0.015			
1.726	1.217	1.220	1.364	1.558
1.395	1.002	1.000	1.119	1.266
0.010	0.006	0.003	0.005	0.007
0.001	0.008	0.000	0.015	0.002
0.001	0.022			
3.014	2.093	2.059	2.306	2.058
2.265	1.547	1.534	1.765	2.105
0.018	0.012	0.007	0.012	0.015
0.001	0.023	0.001	0.022	0.003
0.001	0.030			
2.715	2.294	2.362	3.109	3.736
1.898	1.477	1.485	1.848	2.226
0.016	0.013	0.015	0.025	0.029
0.002	0.046	0.001	0.030	0.003
0.001	0.034			
2.401	2.373	2.725	4.259	5.025
1.576	1.386	1.505	2.174	2.580
0.016	0.016	0.020	0.034	0.038
0.003	0.058	0.001	0.034	0.003
0.001	0.035			
2.052	2.199	2.720	4.689	5.509
1.279	1.220	1.414	2.259	2.664
0.015	0.018	0.022	0.036	0.040
0.003	0.063	0.001	0.035	0.003
0.001	0.034			
1.025	1.999	2.550	4.574	5.374
1.100	1.000	1.290	2.161	2.545
0.014	0.018	0.022	0.034	0.038
0.004	0.063	0.001	0.034	0.003
0.001	0.032			
1.559	1.720	2.254	4.189	4.928
0.920	0.923	1.128	1.945	2.290
0.013	0.017	0.020	0.031	0.035
0.004	0.062	0.001	0.032	0.003
0.001	0.029			
1.289	1.412	1.889	3.618	4.262
0.739	0.749	0.933	1.652	1.946
0.012	0.015	0.018	0.027	0.030
0.005	0.060	0.001	0.029	0.003
0.001	0.027			
1.094	1.179	1.597	3.120	3.660
0.612	0.621	0.782	1.407	1.658
0.011	0.013	0.016	0.023	0.025
0.005	0.058	0.001	0.027	0.002
0.001	0.025			
0.950	1.018	1.388	2.746	3.242
0.526	0.533	0.675	1.220	1.447
0.010	0.012	0.014	0.020	0.022
0.005	0.055	0.001	0.025	0.002
0.001	0.024			
0.820	0.865	1.186	2.373	2.804
0.446	0.451	0.574	1.052	1.241
0.009	0.010	0.012	0.017	0.019
0.004	0.052	0.001	0.024	0.002

SWPA INPUT (1 of 4)

0.001	0.022			
0.706	0.728	1.000	2.021	2.389
0.374	0.378	0.482	0.890	1.050
0.007	0.009	0.010	0.015	0.016
0.004	0.049	0.001	0.022	0.002
0.001	0.020			
0.585	0.594	0.021	1.071	1.977
0.306	0.308	0.394	0.732	0.864
0.006	0.007	0.009	0.012	0.013
0.004	0.045	0.001	0.020	0.002
0.005	0.015			
1.723	1.191	1.227	1.345	1.544
1.420	0.995	1.022	1.120	1.275
0.010	0.006	0.003	0.005	0.007
0.006	0.007	0.005	0.015	0.011
0.007	0.021			
2.911	2.061	2.069	2.351	2.781
2.225	1.544	1.562	1.764	2.001
0.017	0.011	0.007	0.011	0.014
0.009	0.023	0.007	0.021	0.017
0.007	0.030			
2.609	2.256	2.365	3.052	3.633
1.051	1.468	1.505	1.833	2.184
0.016	0.013	0.014	0.025	0.029
0.013	0.046	0.007	0.030	0.019
0.007	0.034			
2.313	2.341	2.718	4.192	4.920
1.535	1.378	1.518	2.154	2.539
0.015	0.016	0.020	0.034	0.038
0.015	0.058	0.007	0.034	0.018
0.006	0.035			
1.980	2.174	2.710	4.018	5.406
1.246	1.214	1.422	2.239	2.027
0.015	0.018	0.022	0.036	0.040
0.017	0.062	0.006	0.035	0.017
0.006	0.034			
1.762	1.978	2.539	4.504	5.276
1.079	1.004	1.304	2.141	2.511
0.014	0.010	0.022	0.035	0.039
0.018	0.063	0.006	0.034	0.016
0.005	0.032			
1.505	1.703	2.243	4.124	4.838
0.096	0.919	1.132	1.926	2.280
0.013	0.017	0.021	0.031	0.035
0.019	0.062	0.005	0.032	0.015
0.005	0.029			
1.245	1.399	1.000	3.560	4.183
0.720	0.746	0.936	1.636	1.920
0.012	0.015	0.018	0.027	0.030
0.020	0.060	0.005	0.029	0.013
0.005	0.027			
1.056	1.168	1.509	3.069	3.611
0.596	0.619	0.784	1.393	1.636
0.011	0.013	0.016	0.023	0.025
0.019	0.058	0.005	0.027	0.012

SWPA INPUT (2 of 4)

0.004	0.025			
0.926	1.008	1.300	2.700	3.101
0.512	0.531	0.677	1.215	1.428
0.010	0.012	0.014	0.020	0.022
0.019	0.055	0.004	0.025	0.011
0.004	0.023			
0.800	0.857	1.179	2.333	2.750
0.434	0.450	0.576	1.041	1.224
0.009	0.010	0.012	0.018	0.019
0.018	0.052	0.004	0.023	0.011
0.004	0.022			
0.682	0.720	0.995	1.986	2.343
0.365	0.377	0.484	0.881	1.036
0.007	0.009	0.010	0.015	0.016
0.017	0.049	0.004	0.022	0.010
0.004	0.020			
0.566	0.588	0.816	1.642	1.939
0.298	0.307	0.395	0.724	0.852
0.006	0.007	0.009	0.012	0.013
0.016	0.045	0.004	0.020	0.009
0.006	0.013			
1.622	1.195	1.237	1.294	1.481
1.407	1.040	1.076	1.125	1.285
0.009	0.005	0.002	0.004	0.006
0.007	0.007	0.006	0.013	0.015
0.010	0.019			
2.585	2.060	2.114	2.285	2.558
2.068	1.012	1.655	1.783	2.001
0.014	0.009	0.007	0.010	0.012
0.013	0.022	0.010	0.019	0.025
0.010	0.030			
2.311	2.215	2.398	2.947	3.381
1.699	1.496	1.579	1.822	2.076
0.015	0.013	0.014	0.025	0.028
0.019	0.045	0.010	0.030	0.026
0.009	0.034			
2.079	2.304	2.728	4.058	4.677
1.414	1.395	1.570	2.130	2.447
0.015	0.016	0.021	0.034	0.039
0.022	0.057	0.009	0.034	0.025
0.008	0.034			
1.798	2.146	2.708	4.463	5.162
1.153	1.227	1.459	2.206	2.545
0.015	0.018	0.023	0.036	0.041
0.024	0.062	0.008	0.034	0.023
0.008	0.033			
1.604	1.955	2.533	4.346	5.039
1.001	1.095	1.335	2.106	2.434
0.015	0.018	0.023	0.035	0.039
0.026	0.063	0.008	0.033	0.022
0.007	0.032			
1.371	1.085	2.235	3.973	4.618
0.832	0.929	1.156	1.892	2.191
0.014	0.017	0.021	0.032	0.035
0.027	0.062	0.007	0.032	0.028

SWPA INPUT (3 of 4)

0.001	0.017			
3.040	2.902	2.785	3.044	3.281
5.313	4.925	4.738	5.040	5.459
0.066	0.040	0.023	0.047	0.061
0.007	0.028	0.001	0.017	0.007
0.002	0.018			
3.376	3.213	3.069	3.142	3.298
4.545	4.252	4.087	4.325	4.650
0.056	0.039	0.031	0.046	0.055
0.008	0.041	0.002	0.018	0.007
0.002	0.019			
3.694	3.467	3.267	3.154	3.252
4.187	3.920	3.754	3.901	4.162
0.053	0.041	0.036	0.047	0.055
0.009	0.048	0.002	0.019	0.007
0.002	0.020			
3.949	3.637	3.370	3.074	3.121
3.804	3.548	3.371	3.404	3.597
0.050	0.042	0.040	0.049	0.054
0.011	0.054	0.002	0.020	0.007
0.002	0.020			
3.923	3.551	3.242	2.845	2.868
3.358	3.108	2.925	2.869	3.007
0.048	0.042	0.041	0.047	0.051
0.012	0.057	0.002	0.020	0.007
0.002	0.019			
3.674	3.289	2.976	2.566	2.584
2.954	2.718	2.541	2.448	2.554
0.042	0.039	0.038	0.044	0.047
0.012	0.057	0.002	0.019	0.006
0.002	0.019			
3.385	3.011	2.710	2.317	2.336
2.633	2.412	2.246	2.141	2.229
0.038	0.036	0.036	0.040	0.043
0.012	0.056	0.002	0.019	0.006
0.002	0.018			
3.030	2.681	2.403	2.043	2.062
2.297	2.097	1.946	1.840	1.912
0.034	0.032	0.032	0.036	0.038
0.012	0.054	0.002	0.018	0.006
0.002	0.017			
2.646	2.332	2.084	1.765	1.784
1.969	1.793	1.660	1.560	1.619
0.029	0.028	0.028	0.031	0.033
0.012	0.051	0.002	0.017	0.005
0.001	0.015			
2.230	1.959	1.740	1.476	1.493
1.637	1.467	1.373	1.285	1.332
0.024	0.024	0.024	0.026	0.028
0.011	0.047	0.001	0.015	0.005

SWPA INPUT (4 of 4)

ANNEX 5

60.000	6	5	13	13	10.000	0	170	85.100	1
0.000	1.000	0.000							
0.250	0.966	15.000							
0.500	0.866	30.000							
0.707	0.707	45.000							
0.866	0.500	60.000							
0.966	0.250	75.000							
1.000	0.000	90.000							
0.966	-0.250	105.000							
0.866	-0.500	120.000							
0.707	-0.707	135.000							
0.500	-0.866	150.000							
0.250	-0.966	165.000							
0.000	-1.000	180.000							
0.000	40.500	40.500	33.000	18.600	34.200				
4.320	62.500	40.500	18.500	27.100	56.200				
7.070	40.500	40.500	18.500	27.100	34.200				
15.020	40.500	40.500	18.500	27.100	34.200				
18.150	31.500	40.500	18.500	27.250	25.200				
3.200	4.000	6.300	7.500	8.000	9.700	10.900	12.400	13.000	15.000
	5	10	15	20	25	30			
1.371	1.361	1.351	1.340	1.338	1.326				

SHORT DAT (1 of 1)

0.005	0.014			
1.073	1.205	1.234	1.334	1.517
1.399	1.024	1.046	1.128	1.273
0.009	0.006	0.003	0.005	0.007
0.006	0.007	0.005	0.014	0.012
0.007	0.021			
2.000	2.069	2.091	2.331	2.706
2.163	1.577	1.603	1.773	2.050
0.016	0.011	0.007	0.011	0.014
0.010	0.023	0.007	0.021	0.019
0.007	0.030			
2.517	2.252	2.303	3.023	3.555
1.798	1.485	1.538	1.833	2.149
0.016	0.013	0.014	0.025	0.029
0.014	0.046	0.007	0.030	0.020
0.007	0.034			
2.244	2.337	2.727	4.152	4.844
1.495	1.390	1.541	2.149	2.510
0.015	0.016	0.020	0.034	0.038
0.017	0.058	0.007	0.034	0.019
0.006	0.035			
1.928	2.172	2.713	4.569	5.328
1.217	1.224	1.439	2.230	2.601
0.015	0.018	0.022	0.036	0.040
0.018	0.062	0.006	0.035	0.018
0.006	0.034			
1.717	1.978	2.541	4.454	5.199
1.055	1.092	1.318	2.131	2.486
0.014	0.018	0.022	0.035	0.039
0.020	0.063	0.006	0.034	0.017
0.005	0.032			
1.467	1.782	2.243	4.075	4.766
0.076	0.926	1.143	1.916	2.238
0.013	0.017	0.021	0.031	0.035
0.021	0.062	0.005	0.032	0.015
0.005	0.029			
1.213	1.399	1.879	3.515	4.118
0.704	0.752	0.944	1.626	1.901
0.012	0.015	0.018	0.027	0.030
0.021	0.060	0.005	0.029	0.014
0.005	0.027			
1.029	1.169	1.500	3.027	3.552
0.583	0.624	0.791	1.384	1.619
0.011	0.013	0.016	0.023	0.025
0.021	0.058	0.005	0.027	0.013
0.004	0.025			
0.902	1.009	1.300	2.662	3.127
0.501	0.535	0.683	1.207	1.412
0.010	0.012	0.014	0.020	0.022
0.021	0.055	0.004	0.025	0.012
0.004	0.023			
0.779	0.858	1.179	2.299	2.703
0.425	0.454	0.581	1.033	1.211
0.009	0.010	0.012	0.018	0.019
0.020	0.052	0.004	0.023	0.011
0.004	0.022			
0.664	0.721	0.995	1.950	2.301
0.357	0.380	0.488	0.874	1.024
0.007	0.009	0.010	0.015	0.016
0.010	0.049	0.004	0.022	0.010

ABBREVIATED SCSMOT.DAT (1 of 4)

0.004	0.020			
0.551	0.590	0.016	1.617	1.904
0.292	0.309	0.398	0.718	0.042
0.006	0.007	0.009	0.012	0.013
0.017	0.045	0.004	0.020	0.009
0.005	0.014			
1.638	1.213	1.241	1.329	1.498
1.384	1.047	1.068	1.140	1.273
0.009	0.005	0.003	0.004	0.006
0.006	0.007	0.005	0.014	0.013
0.008	0.021			
2.721	2.074	2.114	2.313	2.650
2.119	1.604	1.641	1.781	2.029
0.016	0.011	0.007	0.011	0.013
0.011	0.022	0.008	0.021	0.020
0.008	0.030			
2.458	2.255	2.402	3.000	3.497
1.764	1.505	1.570	1.834	2.123
0.016	0.013	0.014	0.025	0.029
0.016	0.045	0.008	0.030	0.022
0.007	0.034			
2.205	2.340	2.736	4.118	4.703
1.472	1.405	1.564	2.146	2.488
0.016	0.016	0.020	0.034	0.038
0.018	0.057	0.007	0.034	0.020
0.007	0.035			
1.900	2.175	2.717	4.528	5.263
1.201	1.236	1.455	2.223	2.500
0.015	0.018	0.023	0.036	0.041
0.020	0.062	0.007	0.035	0.019
0.007	0.034			
1.093	1.000	2.543	4.411	5.135
1.042	1.103	1.331	2.123	2.466
0.015	0.018	0.022	0.035	0.039
0.022	0.063	0.007	0.034	0.018
0.006	0.032			
1.447	1.705	2.244	4.033	4.705
0.007	0.035	1.154	1.907	2.219
0.014	0.017	0.021	0.032	0.035
0.023	0.062	0.006	0.032	0.017
0.006	0.029			
1.196	1.402	1.079	3.476	4.063
0.096	0.759	0.952	1.018	1.004
0.012	0.015	0.018	0.027	0.030
0.023	0.060	0.006	0.029	0.015
0.005	0.027			
1.014	1.172	1.508	2.992	3.503
0.576	0.630	0.797	1.376	1.604
0.011	0.013	0.016	0.023	0.026
0.023	0.058	0.005	0.027	0.014
0.005	0.025			
0.008	1.013	1.300	2.029	3.002
0.495	0.541	0.688	1.199	1.399
0.010	0.012	0.014	0.020	0.022
0.022	0.055	0.005	0.025	0.013
0.005	0.023			
0.767	0.002	1.179	2.269	2.602
0.420	0.458	0.585	1.027	1.199
0.009	0.010	0.012	0.018	0.019
0.022	0.052	0.005	0.023	0.012

ABBREVIATED SCSMOT.DAT (2 of 4)

0.004	0.022			
0.054	0.724	0.995	1.930	2.266
0.353	0.384	0.492	0.808	1.014
0.007	0.009	0.010	0.015	0.016
0.020	0.049	0.004	0.022	0.011
0.004	0.020			
0.542	0.593	0.816	1.595	1.873
0.288	0.313	0.402	0.713	0.834
0.006	0.007	0.009	0.012	0.013
0.019	0.045	0.004	0.020	0.010
0.006	0.013			
1.536	1.227	1.258	1.312	1.441
1.341	1.103	1.131	1.169	1.268
0.009	0.005	0.003	0.004	0.006
0.008	0.006	0.006	0.013	0.017
0.009	0.020			
2.520	2.094	2.171	2.268	2.504
2.012	1.682	1.747	1.888	1.976
0.017	0.011	0.007	0.010	0.013
0.014	0.021	0.009	0.020	0.024
0.009	0.029			
2.329	2.277	2.454	2.943	3.344
1.695	1.569	1.661	1.845	2.063
0.017	0.014	0.014	0.025	0.029
0.020	0.045	0.009	0.029	0.025
0.008	0.033			
2.130	2.359	2.762	4.025	4.615
1.434	1.458	1.630	2.140	2.431
0.016	0.017	0.021	0.034	0.039
0.023	0.057	0.008	0.033	0.023
0.007	0.034			
1.852	2.194	2.720	4.410	5.081
1.180	1.279	1.503	2.205	2.523
0.016	0.019	0.023	0.037	0.041
0.025	0.062	0.007	0.034	0.022
0.007	0.033			
1.653	1.998	2.549	4.289	4.953
1.027	1.140	1.370	2.101	2.411
0.015	0.019	0.023	0.035	0.039
0.026	0.063	0.007	0.033	0.020
0.007	0.031			
1.413	1.722	2.247	3.914	4.533
0.855	0.966	1.104	1.883	2.167
0.014	0.018	0.021	0.032	0.036
0.027	0.062	0.007	0.031	0.019
0.007	0.029			
1.106	1.417	1.880	3.366	3.907
0.688	0.784	0.976	1.594	1.838
0.013	0.016	0.019	0.028	0.031
0.020	0.060	0.007	0.029	0.017
0.006	0.027			
0.988	1.186	1.588	2.891	3.362
0.569	0.650	0.816	1.354	1.564
0.012	0.014	0.016	0.024	0.026
0.027	0.057	0.006	0.027	0.015

ABBREVIATED SCSMOT.DAT (3 of 4)

ANNEX 6

0.006	0.025			
0.065	1.026	1.300	2.537	2.954
0.489	0.559	0.705	1.179	1.363
0.010	0.012	0.015	0.021	0.023
0.027	0.055	0.006	0.025	0.014

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0.003	0.017			
3.035	2.905	2.791	3.040	3.267
5.201	4.847	4.662	4.945	5.342
0.062	0.037	0.022	0.044	0.057
0.015	0.028	0.003	0.017	0.013
0.003	0.018			
3.341	3.193	3.062	3.148	3.299
4.445	4.178	4.020	4.247	4.556
0.053	0.037	0.030	0.044	0.052
0.016	0.041	0.003	0.018	0.013
0.003	0.019			
3.643	3.435	3.253	3.167	3.264
4.090	3.847	3.690	3.835	4.083
0.050	0.040	0.035	0.045	0.052
0.017	0.048	0.003	0.019	0.013
0.003	0.020			
3.890	3.598	3.351	3.093	3.142
3.711	3.477	3.311	3.352	3.536
0.048	0.041	0.039	0.047	0.052
0.017	0.054	0.003	0.020	0.012
0.002	0.020			
3.864	3.512	3.223	2.865	2.890
3.273	3.043	2.872	2.829	2.960
0.045	0.041	0.040	0.046	0.049
0.018	0.057	0.002	0.020	0.011
0.002	0.019			
3.620	3.253	2.959	2.584	2.604
2.870	2.660	2.495	2.415	2.516
0.041	0.038	0.037	0.042	0.045
0.018	0.057	0.002	0.019	0.010
0.002	0.019			
3.335	2.978	2.694	2.333	2.353
2.566	2.360	2.205	2.113	2.197
0.037	0.035	0.035	0.039	0.041
0.017	0.056	0.002	0.019	0.009
0.002	0.018			
2.986	2.652	2.390	2.057	2.076
2.238	2.052	1.911	1.817	1.885
0.033	0.031	0.031	0.035	0.037
0.017	0.054	0.002	0.018	0.009
0.002	0.017			
2.688	2.307	2.072	1.777	1.795
1.919	1.754	1.629	1.540	1.597
0.028	0.027	0.027	0.030	0.032
0.016	0.051	0.002	0.017	0.008
0.002	0.015			
2.198	1.939	1.737	1.485	1.502
1.595	1.455	1.348	1.269	1.314
0.024	0.023	0.023	0.025	0.027
0.015	0.047	0.002	0.015	0.007

ABBREVIATED SCSMOT.DAT (4 of 4)

0.2 0.2 2.4 2.2 1.0 1.9 1.1 1.0 0.4 0.3 0.2 0.1 0.0
0.0 0.1 2.7 4.0 3.0 3.0 2.1 2.1 1.0 1.0 0.4 0.2 0.2
0.0 0.0 0.0 1.9 5.1 5.3 3.3 2.5 1.3 1.0 0.5 0.3 0.1
0.0 0.0 0.0 0.0 0.0 4.0 3.9 3.4 1.3 1.0 0.5 0.2 0.1
0.0 0.0 0.0 0.0 0.0 0.0 3.3 3.6 1.3 1.0 0.5 0.3 0.1
0.0 0.0 0.0 0.0 0.0 0.0 0.7 3.3 1.4 1.0 0.5 0.3 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.5 1.3 1.1 0.5 0.3 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.3 0.0 0.0 0.4 0.2 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.3 0.7 0.4 0.2 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.2 0.4 0.2 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.1 0.3 0.2 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.2 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

SEADAT.DAT (1 of 1)

11.483
0 0 0
1.00 2.5 5.0
1.0 1.0 50.0 50.0
0.2 1.0 50.0 50.0
1.0 0.1 50.0 50.0
1.0 1.0 50.0 50.0
1.0 1.0 50.0 50.0
0.25 0.05 0.125 0.025 7.5 1.5
70.0
13
1.640 4.921 8.202 11.483 14.764 18.045 21.325 24.606
27.887 31.168 36.089 42.651 49.213

CREEP.DAT (1 of 1)

VERTICAL ACCELERATION EFFECTIVENESS ARRAY

SPEED	WAVE HT.	WAVE PERIOD														
		3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0		
5.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.44	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	92.26	95.56	98.24	0.00	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.52	98.02	99.37	0.00	0.00
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.09	97.50	99.08	99.80	0.00	0.00	0.00
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.44	97.40	98.92	99.70	99.99	0.00	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.16	99.05	99.68	99.98	100.00	0.00	0.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	97.43	99.11	99.82	99.98	100.00	100.00	0.00	0.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	0.00	98.76	99.41	99.90	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	11.5 *	0.00	0.00	0.00	0.00	99.80	99.89	99.99	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	8.2 *	0.00	0.00	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
10.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.85	0.00	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	92.39	95.16	97.47	0.00	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.32	97.40	98.99	0.00	0.00
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.12	97.04	98.62	99.59	0.00	0.00	0.00
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.97	97.09	98.49	99.51	99.92	0.00	0.00	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.20	98.72	99.50	99.92	100.00	0.00	0.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	97.77	98.97	99.68	99.96	100.00	100.00	0.00	0.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	0.00	99.15	99.48	99.88	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	11.5 *	0.00	0.00	0.00	0.00	99.98	99.98	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	8.2 *	0.00	0.00	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
15.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.06	0.00	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.65	94.22	96.75	0.00	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.58	96.61	98.42	0.00	0.00
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.62	96.37	97.99	99.31	0.00	0.00	0.00
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.72	96.57	97.95	99.12	99.81	0.00	0.00	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.91	98.28	99.21	99.79	100.00	0.00	0.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	97.83	98.73	99.53	99.86	100.00	100.00	0.00	0.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	0.00	99.30	99.46	99.80	99.99	100.00	100.00	100.00	100.00	0.00	0.00
	11.5 *	0.00	0.00	0.00	0.00	99.99	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	8.2 *	0.00	0.00	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
	1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00

ANNEX 9

20.00	3.2	4.0	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	92.99
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.86	93.38	95.87	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.85	95.85	97.79	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.05	95.70	97.35	98.86	0.00
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.53	96.06	97.39	98.65	99.63	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.67	97.85	98.84	99.62	99.95	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	97.91	98.53	99.28	99.73	99.97	100.00	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	99.37	99.47	99.72	99.93	100.00	100.00	100.00	100.00
11.5 *	0.00	0.00	0.00	0.00	99.99	99.98	99.99	100.00	100.00	100.00	100.00	100.00	100.00
8.2 *	0.00	0.00	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

25.00	3.2	4.0	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	92.25	0.00
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.16	92.73	95.20	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.14	95.27	97.19	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.57	95.05	96.82	98.36	0.00
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.29	95.60	96.80	98.20	99.33	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.40	97.43	98.36	99.33	99.88	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	97.91	98.30	98.97	99.55	99.92	100.00	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	99.45	99.43	99.64	99.89	99.99	100.00	100.00	100.00
11.5 *	0.00	0.00	0.00	0.00	99.98	99.99	99.99	100.00	100.00	100.00	100.00	100.00	100.00
8.2 *	0.00	0.00	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

30.00	3.2	4.0	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.45	0.00
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	89.70	91.96	94.54	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	92.68	94.61	96.63	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.19	94.64	96.22	97.91
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.20	95.26	96.41	97.74	99.02	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.27	97.15	98.04	99.00	99.78	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	97.92	98.14	98.76	99.34	99.83	100.00	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	99.41	99.39	99.55	99.83	99.98	100.00	100.00	100.00
11.5 *	0.00	0.00	0.00	0.00	99.96	99.98	99.98	100.00	100.00	100.00	100.00	100.00	100.00
8.2 *	0.00	0.00	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

ANNEX 9

20.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.91	0.00
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.22	61.44	63.62	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.09	66.00	67.82	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.15	67.29	68.95	70.74
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.23	69.51	71.06	73.47	76.26	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.31	75.85	77.31	79.32	81.64	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	80.78	80.97	82.21	83.32	84.92	86.72	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	88.08	87.21	87.31	88.13	88.91	90.00	91.09	92.37
11.5 *	0.00	0.00	0.00	0.00	94.45	93.48	92.72	92.54	92.88	93.26	93.89	94.66	95.57
8.2 *	0.00	0.00	0.00	99.69	97.90	97.15	96.59	96.44	96.63	96.88	97.22	97.71	98.29
4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	99.94	99.86	99.97	100.00	100.00	100.00	100.00
1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

25.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.20	0.00
36.1 *	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	61.69	63.62	65.55	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.21	67.83	69.44	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.98	69.14	70.55	72.15	0.00
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.91	71.08	72.79	75.01	77.46	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.15	77.28	78.75	80.58	82.60	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	82.54	82.47	83.35	84.49	85.85	87.45	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	89.74	88.64	88.44	88.98	89.61	90.38	91.35	92.58
11.5 *	0.00	0.00	0.00	0.00	95.38	94.26	93.29	92.94	93.15	93.54	94.09	94.77	95.68
8.2 *	0.00	0.00	0.00	100.00	98.54	97.64	96.92	96.63	96.71	96.95	97.29	97.71	98.29
4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	99.97	100.00	100.00	100.00	100.00	100.00
1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

30.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.97	0.00
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.48	65.07	67.05	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.76	69.14	70.88	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.46	70.57	71.78	73.71	0.00
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.08	73.08	74.47	76.43	78.81	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.18	79.01	80.14	81.81	83.77	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	84.45	84.12	84.77	85.60	86.78	88.16	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	91.17	89.96	89.49	89.67	90.08	90.79	91.71	92.81
11.5 *	0.00	0.00	0.00	0.00	96.31	95.08	93.95	93.46	93.54	93.82	94.32	94.92	95.68
8.2 *	0.00	0.00	0.00	100.00	99.11	98.18	97.35	96.92	96.92	97.08	97.40	97.80	98.34
4.9 *	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

OVERALL EFFECTIVENESS ARRAY

SPEED	WAVE HT.	WAVE PERIOD												
		3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
5.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.28
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.31	54.05	56.00	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.25	59.62	61.96	0.00
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.58	61.21	63.69	67.26	0.00
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.18	64.63	67.07	70.18	73.33	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	69.62	71.95	74.02	76.62	79.27	0.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	75.57	77.24	79.13	80.82	82.89	84.94	0.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	82.83	83.39	84.61	85.97	87.18	88.74	90.28	91.89	0.00
	11.5 *	0.00	0.00	0.00	90.35	90.29	90.60	91.32	92.09	92.82	93.65	94.52	95.57	0.00
	8.2 *	0.00	0.00	0.00	97.10	96.26	96.07	96.06	96.33	96.69	97.11	97.63	98.18	98.75
	4.9 *	0.00	100.00	100.00	100.00	99.82	99.75	99.79	99.95	100.00	100.00	100.00	100.00	100.00
	1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00
10.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.14	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.56	56.03	58.74	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.21	61.33	63.62	0.00
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.48	62.97	64.83	67.81	0.00
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	63.85	65.56	67.74	70.58	73.79	0.00	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	70.55	72.62	74.56	76.99	79.64	0.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	76.83	77.99	79.69	81.26	83.20	85.33	0.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	84.16	84.30	85.15	86.38	87.56	88.98	90.51	92.04	0.00
	11.5 *	0.00	0.00	0.00	91.83	91.23	91.22	91.69	92.31	92.86	93.60	94.51	95.55	0.00
	8.2 *	0.00	0.00	0.00	97.92	96.76	96.34	96.17	96.31	96.64	96.98	97.44	97.93	98.49
	4.9 *	0.00	100.00	100.00	100.00	99.97	99.83	99.75	99.83	99.98	100.00	100.00	100.00	100.00
	1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00
15.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.11	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.61	58.45	61.25	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.84	63.42	65.79	0.00
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.87	65.31	66.68	69.23	0.00
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	66.18	67.52	69.36	71.77	75.02	0.00	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	72.39	74.18	75.95	77.98	80.68	0.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	78.72	79.47	80.88	82.38	83.98	86.04	0.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	86.09	85.68	86.19	87.14	88.27	89.45	90.84	92.18	0.00
	11.5 *	0.00	0.00	0.00	93.15	92.42	92.05	92.14	92.54	93.08	93.75	94.60	95.55	0.00
	8.2 *	0.00	0.00	0.00	98.90	97.29	96.69	96.37	96.36	96.58	96.89	97.30	97.78	98.35
	4.9 *	0.00	100.00	100.00	100.00	100.00	99.96	99.82	99.82	99.94	100.00	100.00	100.00	100.00
	1.6 *	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

ANNEX 9

20.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.91	0.00
36.1 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.22	61.44	63.62	0.00
31.2 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.09	66.00	67.82	0.00
27.9 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.15	67.29	68.95	70.74
24.6 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.23	69.51	71.06	73.47	76.26	0.00
21.3 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.31	75.65	77.31	79.32	81.64	0.00
18.0 •	0.00	0.00	0.00	0.00	0.00	0.00	80.70	80.97	82.21	83.32	84.92	86.72	0.00
14.8 •	0.00	0.00	0.00	0.00	0.00	85.08	87.21	87.31	88.13	88.91	90.00	91.09	92.37
11.5 •	0.00	0.00	0.00	0.00	94.45	93.48	92.72	92.54	92.88	93.26	93.89	94.66	95.57
8.2 •	0.00	0.00	0.00	99.69	97.90	97.15	96.59	96.44	96.63	96.88	97.22	97.71	98.29
4.9 •	0.00	100.00	100.00	100.00	100.00	100.00	99.94	99.86	99.97	100.00	100.00	100.00	100.00
1.6 •	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

25.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.20	0.00
36.1 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.69	63.62	65.55	0.00
31.2 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.21	67.83	69.44	0.00
27.9 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.98	69.14	70.55	72.15	0.00
24.6 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.91	71.06	72.79	75.01	77.46	0.00
21.3 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.15	77.28	78.75	80.58	82.60	0.00
18.0 •	0.00	0.00	0.00	0.00	0.00	0.00	82.54	82.47	83.35	84.49	85.85	87.45	0.00
14.8 •	0.00	0.00	0.00	0.00	0.00	89.74	88.64	88.44	88.98	89.61	90.38	91.35	92.58
11.5 •	0.00	0.00	0.00	0.00	95.38	94.26	93.29	92.94	93.15	93.54	94.09	94.77	95.60
8.2 •	0.00	0.00	0.00	100.00	98.54	97.64	96.92	96.63	96.71	96.95	97.29	97.71	98.29
4.9 •	0.00	100.00	100.00	100.00	100.00	100.00	100.00	99.97	100.00	100.00	100.00	100.00	100.00
1.6 •	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

30.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.97	0.00
36.1 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.44	65.07	67.05	0.00
31.2 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.76	69.14	70.60	0.00
27.9 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.46	70.57	71.78	73.71	0.00
24.6 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.08	73.08	74.47	76.43	78.81	0.00
21.3 •	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.18	79.01	80.14	81.81	83.77	0.00
18.0 •	0.00	0.00	0.00	0.00	0.00	0.00	84.45	84.12	84.77	85.60	86.78	88.16	0.00
14.8 •	0.00	0.00	0.00	0.00	0.00	91.17	89.96	89.49	89.67	90.00	90.79	91.71	92.81
11.5 •	0.00	0.00	0.00	0.00	96.31	95.08	93.95	93.46	93.54	93.82	94.32	94.92	95.60
8.2 •	0.00	0.00	0.00	100.00	99.11	98.18	97.35	96.92	96.92	97.08	97.40	97.60	98.34
4.9 •	0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.6 •	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

ANNEX 9

OPERATIONAL HEADING FRACTION

SPEED	WAVE MT.	WAVE PERIOD												
		3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
5.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.46	0.05
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.62	1.00	1.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	11.5 *	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	8.2 *	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	4.9 *	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	1.6 *	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
10.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.38
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.23	0.31	0.54	0.05	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.69	1.00	1.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	11.5 *	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	8.2 *	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	4.9 *	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	1.6 *	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
15.00	49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.23
	27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.31	0.38	0.00
	24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.31	0.46	0.62	1.00	0.00
	21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.85	1.00	1.00	0.00
	18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
	14.8 *	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	11.5 *	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	8.2 *	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	4.9 *	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	1.6 *	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

ANNEX 9

20.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.31	0.38	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31	0.38	0.54
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.46	0.54	0.77	1.00	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	1.00	1.00	1.00	1.00	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11.5 *	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8.2 *	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4.9 *	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.6 *	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

25.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.23	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.38	0.46	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.38	0.54	0.62	0.00
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.54	0.62	1.00	1.00	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11.5 *	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8.2 *	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4.9 *	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.6 *	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

30.00	3.2	4.8	6.3	7.5	8.8	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.7 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00
36.1 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.23	0.00
31.2 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.46	0.54	0.00
27.9 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.46	0.62	0.77	0.00
24.6 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.69	0.85	1.00	1.00	0.00
21.3 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
18.0 *	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
14.8 *	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11.5 *	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8.2 *	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4.9 *	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.6 *	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

SUSTAINABLE SPEED ARRAY

WAVE HT	3.2	4.0	6.3	7.5	8.0	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	0.00
36.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	0.00
31.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	0.00
27.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	0.00
24.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	0.00
21.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	0.00
18.05	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	0.00
14.76	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
11.48	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
8.20	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
4.92	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
1.64	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	0.00

EFFECTIVE SPEED ARRAY

WAVE HT	3.2	4.0	6.3	7.5	8.0	9.7	10.9	12.4	13.8	15.0	16.4	18.0	20.0
49.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.62	0.00
36.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.92	6.92	6.92	0.00
31.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.54	13.85	16.15	0.00
27.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.85	13.85	18.46	23.06	0.00
24.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.46	20.77	25.38	30.00	30.00	0.00
21.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	0.00
18.05	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	0.00
14.76	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
11.48	0.00	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
8.20	0.00	0.00	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
4.92	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
1.64	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	0.00

SWSPA OUTPUT (11 of 12)

OVER-ALL SEAKEEPING PERFORMANCE

MEAN SUSTAINABLE SPEED= 30.00

MEAN EFFECTIVE SPEED= 29.30

SPEED (KT)	VERT. ACC.	EFFECTIVENESS FACTORS(PERCENT)			OVER-ALL	FRACTION
		LAT. ACC.	ROLL			
5.0	99.7	91.1	100.0	91.1	.937	
10.0	99.7	91.5	100.0	91.5	.942	
15.0	99.6	92.1	100.0	92.1	.952	
20.0	99.6	92.7	100.0	92.7	.964	
25.0	99.5	93.3	100.0	93.3	.970	
30.0	99.4	93.9	100.0	93.9	.977	

SWSPA OUTPUT (12 of 12)

REFERENCES:

1. Nethercote, W.C.E., Piggott, S.D. and Savory, M.W.: "SWATH2: A Computer Program for the Prediction of SWATH Ship Motions in Regular and Irregular Waves". DREA Technical Memorandum 85/217, September 1985.
2. Hogben, N. and Lumb, F.E.: Ocean Wave Statistics, Her Majesty's Stationery Office, London, 1967.
3. Cummins, W.E. and Bales, S.L.: "Extreme Value and Rare Occurrence Wave Statistics for Northern Hemispheric Shipping Lanes", SNAME STAR Symposium, June 1980.
4. Bales, S.L., Lee, W.T. and Voelcker, J.M.: "Standardized Wave and Wind Environments for NATO Operational Areas", DTNSRDC Report SPD-0919-01, July 1981.
5. "Standardized Wave and Wind Environments and Shipboard Reporting of Sea Conditions", NATO STANAG 4194.

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13. ABSTRACT A computer program package for assessing the seakeeping performance of SWATH ships is described. This package is based on an existing ship motion computer program, SWATM2. The seakeeping performance analysis process is automated and combined with a recently-published North Atlantic wave data base. The resulting package performs the following functions: (1) Computes ship motions for the entire range of sea conditions for a user-specified ocean area in the North Atlantic. (2) Applies seakeeping criteria to compute seakeeping performance parameters, such as maximum sustainable speed and maximum effective speed, for each heading and sea condition. (3) Averages the seakeeping performance parameters over all headings to obtain mean values for each sea condition. (4) Obtains averages over all sea conditions by weighting each sea condition in accordance with the North Atlantic wave data base.			

1515
16-78

KEY WORDS

SWATH
 Ship motion computer program
 Seakeeping performance
 wave data base
 North Atlantic

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